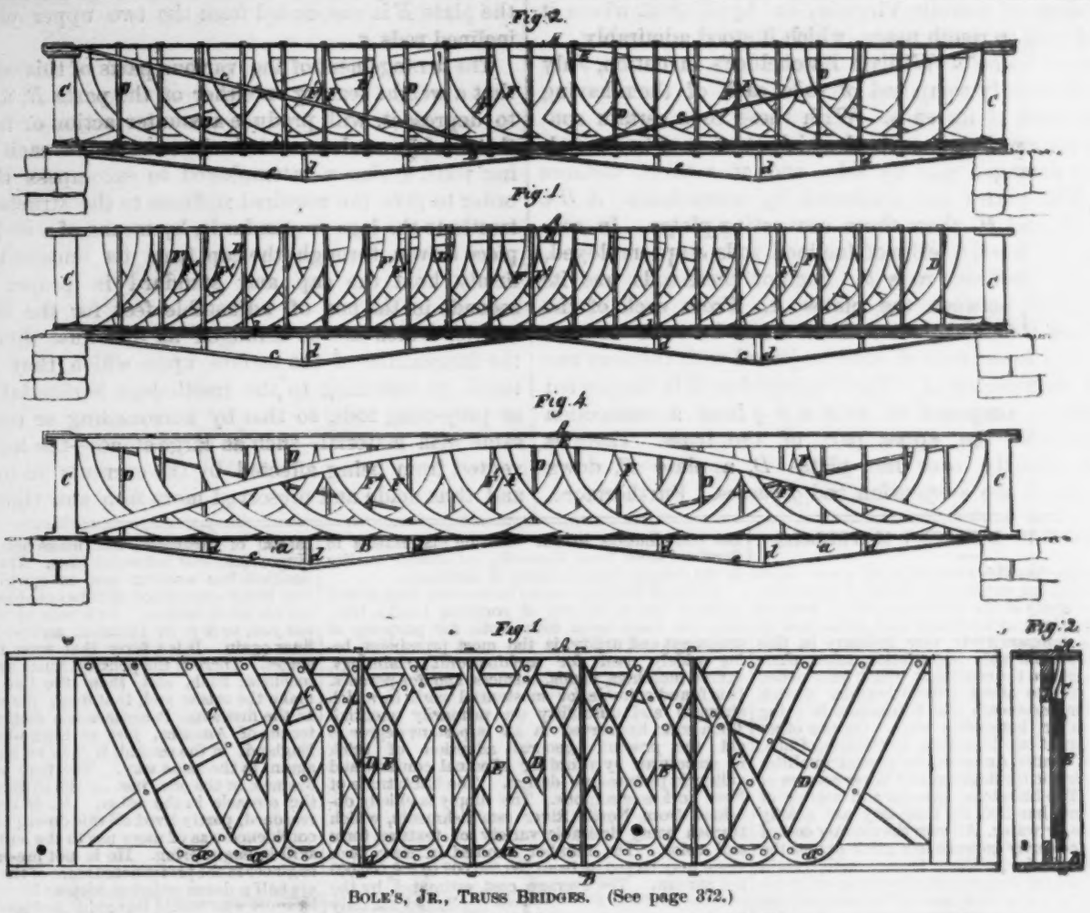
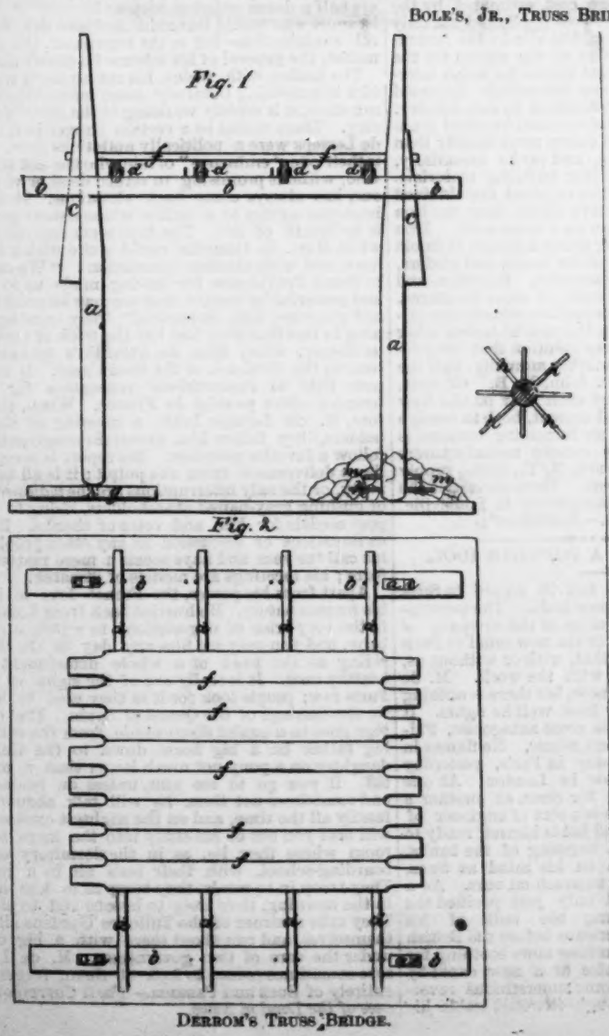
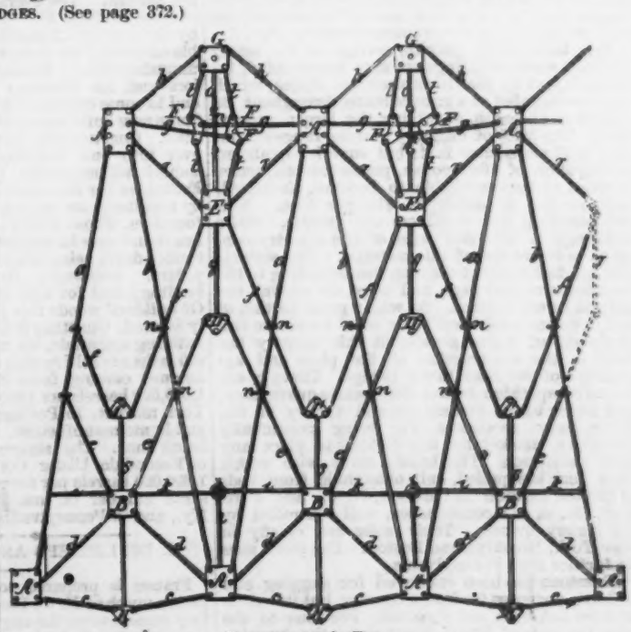


BOLE'S, JR., TRUSS BRIDGES. (See page 372.)



DERROM'S TRUSS BRIDGE.



BATCHELDER'S TRUSS.

July 4, 1865, Andrew Derrom devised the truss bridge shown by the accompanying cuts.

The improvement consists, first, in securing the cap of the

The trestles, constructed and arranged as above described, when desired to bridge a stream, are sunk, one after another, until they rest upon the bottom, and the balks and planking laid. If any trestle should settle, thus causing the road-bed to be uneven, it is easily obviated, it is stated, by first loosening the wedges of the trestle, when the cap piece can then be raised to the proper level by any suitable lever arrangement. It is again fastened by setting the wedge as before.

A bridge of this description was erected by Derrom, dur-

ing the siege of Suffolk, Virginia, in April, 1863, where it was subjected to rough usage, which it stood admirably.

The truss frame of William Batchelder's invention, July 11, 1865, is mainly composed of rods, each of them having an eye at each of its ends. With these rods certain connections are employed, each of which consists of two metallic plates arranged side by side, and at a short distance apart. The plates are connected by screw-bolts. *A B C D E F G* and *H* show these connecting plates. In constructing the truss, a series of inclined rods *a* are employed, and counter inclined rods *b*. Each of these rods has its eyes inserted between the plates *A*. From each of the connections *B* extend four rods *d d e e* in such manner that the two lower rods *d* shall be joined with the next two adjacent connections *A*. Each connection *D* is suspended by a hanger composed of rods *o p q* from a connection *G* disposed at the upper part of the truss. There is arranged directly over the plates *D*, a plate *E*, down through which the suspension rod *g* passes. Furthermore, the plate *E* is suspended from the two upper plates *A* by inclined rods *r*.

The arrangement of the various parts of this truss is such that a weight bearing on either of the parts *B*, and tending to depress it, will produce a counter action or tendency of the truss to camber. At the intersection of each two crossing rods, a ring *n* is employed to encompass the two in order to give the required stiffness to the structure.

trestle to the legs or standards, by means of a wedge-shaped piece driven through the cap from its underside, so as to firmly hold the cap and standard in proper position; second, in the use of adjustable feet for the legs of the trestle, which are so arranged as to adjust themselves to the inequalities of the surface upon which they may rest; third, in attaching to the trestle-legs horizontal radiating or projecting rods, so that by surrounding or covering the same with material—such as large stones—the legs are prevented from being affected by the currents in the stream, and thus made and preserved more firm and rigid.

THE TRADE IN BUILDING MATERIALS.

This country has the advantage of great capability in producing varieties of building materials, but the contiguity of the British provinces leads to such importations as freestone and laths, and in cements, a comparatively new industry in this country, a considerable importation takes place from England and the continent, which has reached so far this year to about 150,000 barrels. Scotch freestone for basements and trimmings is being imported on an increasing scale. On the other hand, we export our bluestone to Canada, Cuba, Mexico and South America, its special qualities recommending it for flagging and lower courses of buildings. The bluestone, granite and marble of New England handled in this city are chiefly brought here by water. All over the country cost of transport necessarily governs to a great extent the selection of stone for building, though with certain important edifices distance is allowed to offer no impediment to the conveyance of huge quantities of New England stone to remote Western cities.

The business in granite, owing to the larger scale on which buildings are now constructed, increases year by year in this section, Maine, which may be regarded as a granite State throughout its length and breadth, supplying the larger proportion. The price of ordinary granite ranges from 75c. to $1 per square foot; but superior qualities, which allow of a fine polish, present an attractive surface, and are not liable to become discolored, will realize as much as $10 per foot. Notwithstanding the costliness of granite, entire buildings in different parts of the country continue to be erected of this material. The stone is cut and fashioned at the quarries according to the architectural drawings, and thus, on arrival, has only to be set in place. So with a great portion of the freestone used here. The most extensive employment of Maine granite in this country has been in the construction of the piers and approaches of the East River Bridge. There is extreme competition among the granite quarrymen, and owing to the abundance and variety of the stone, new specimens are being continually brought to market, but it is difficult to place any new description. The brown stone with which New York is supplied, only obtainable from beds of limited location in Paterson, N. J., and Portland, Ct., is, as a consequence, well controlled by the quarry owners. Their sales are chiefly in New York, Brooklyn and Boston. The stone goes no further than Pennsylvania.

Bluestone has been employed for flagging and building purposes for half a century, but its extensive use has been more recent. Previous to the adoption here of North River stone the quarries on the Connecticut River were chiefly drawn on for New York flagging. Pennsylvania supplies New York with a moderate proportion. This stone, which is extensively used for trimmings for buildings, for water tables, lower cills, lintels, large platforms, and for rubbing and polishing, goes to all parts of the country. The cost of the rough quarried stone handled here does not exceed $2,000,000 per annum, but the labor expended in shaping it, with cost of freight, brings this amount up to $9,000,000. The figures given for freestone (brown) by qualified estimators closely approximate to the above. Cost of labor in cutting and dressing both blue and freestone has been greatly reduced of late years by the powerful iron planers employed for these purposes.

The marble used in this section, a good part of it employed in interiors for mantels, is from Vermont, which supplies every desirable quality and color. Limestone from Ohio, Indiana and even more distant States is also furnished. An important contribution to our building materials is in Portland stone from Kentucky, of similar quality to the famous English stone of that name.

Artificial building stones have come into prominence of late in the way of concrete blocks, tiles, etc. Of these terra cotta, both for purposes of ornament and utility, is the most prominent, being widely used for architectural trimmings, carved moldings, bands, cornices and for porches. It is found suitable for substantial work in which strength and durability are primarily essential. Terra cotta has served in an important degree to aid the present general adoption of brick in structures by affording effectual contrast and aiding in picturesque design. The brick trade of New York is enormous. The supply is chiefly obtained from North River establishments, which furnish every desirable variety of texture, form and color. The number handled in New York alone may be put at from 700,000,000 to 800,000,000 per annum. The average cost, estimated by the car load, is $6 to $7. The cost is affected not only by the activity of building, but also by the favorable character or otherwise of the season for the manufacturer. Enameled bricks for lining interiors and for floorings are extensively imported and to some extent manufactured in this country. Some new buildings contain several hundred thousand. Construction iron enters more largely than ever into our buildings, and ranks essentially, though not nominally, under building materials. Estimates for the quantities required are obtained by architects or contractors direct from the iron founders, whose works are on a large scale. Iron has found uses in building never dreamed of in old timber days, being adapted for beams and girders, pillars, stairways, balustrades, floorings and landings, and for first stories of store frontages. Of builders' woods this journal has already specially treated. Omitting from the present notice other building materials, we may mention that 150,000,000 laths are sold in this market annually, half the amount coming from St. John, N. B. Of lime, 1,500,000 barrels are placed each year on the New York market. In Portland cement, both in foreign and home manufacture, an increasing business is being done. The sixteen cement manufacturers of Rosendale, Ulster County, N. Y., alone supply 1,600,000 barrels per annum. There are about the same number of manufacturerers in Louisville, Ky., and in Pennsylvania.—*Bradstreet's.*

M. DE LESSEPS AS A POPULAR IDOL.

France is prepared to feel in regard to Suez pretty much as M. de Lesseps feels. The peremptory summons to the engineers of the company of Suez to bring their plans for the new canal to Paris at once is meant to show that, with or without us, M. de Lesseps will go on with the work. M. de Lesseps is fighting us just now, but there is nothing to prevent us from saying how well he fights. It is the jaunty courage of his great antagonist, Palmerston, set off with French *finesse*. He flames in every part of the field—to-day in Paris, yesterday in Ismailia and to-morrow in London. At one moment it is a meeting for Suez, at another a meeting for Panama. He is a sort of engineer of the public confidence, and holds himself ready to fly anywhere to avert a bursting of the banks. Panama is just as much on his mind as Suez, though we forget it is not so much on ours. As a matter of fact, he had only just pacified the United States by giving the bulk of his Panama contracts to Americans before the British broke out. Yet he has nothing more soothing for either side than the promise of a new canal by 1888. He seems to have some superstitious reverence for this date, as though it would treble his capital of greatness, and make him, like Victor Hugo, immortal before his time. The truth is, opposition has nothing new to say to him; a long and bitter experience of it has enabled him to formulate all its terrors. As it was at Suez, he will tell you, so it is at Panama, and so it will be at Suez again. It is a fever that runs its course by stages. There is the political flush and then the technical flush, and then the two combine to make the crisis; and, that over, the worst is past. In the first stage Panama was a danger to the interests of America, just as Suez was a danger to England; in the second, it was an impossibility—again, in the same way. The firm rock was the obstacle in the one, just as the shifting sand was the obstacle in the other. M. de Lesseps partly reasoned, partly lived all this down; his wonderful confidence was of more use to the enterprise than skill in engineering. He is not pre-eminently an engineer in the professional sense of the term—there are half a dozen noiseless men on his staff at either isthmus who would leave him nowhere in a technical examination—but as the negotiator, the diplomatist, the general of his scheme he stands alone.

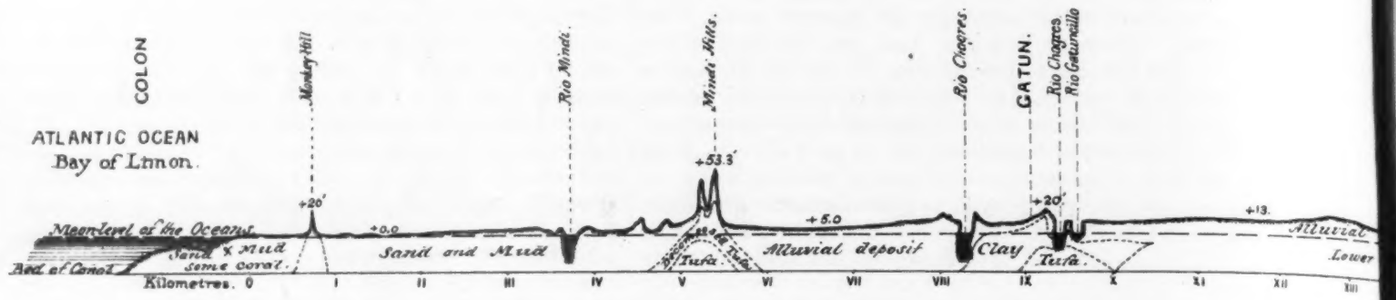
The feeling with which his countrymen regard him is something infinitely more intense than admiration; it is rapidly warming to the glow of idolatry. There would be a certain danger in it if M. de Lesseps were a politically ambitious man. He is their one "eminence" of late who has not failed, who, without promising to return dead or victorious, has always come back victorious. It is an immense service to a nation whose *amour propre* is its breath of life. The days seem forever past when Mme. de Girardin could write with a light heart and with absolute conviction: "We ought to thank Providence for having made us so fine and powerful by nature, that we may be confident and generous with impunity." They were beginning to feel that they had lost the trick of making us uneasy, when Mme. de Girardin's providence sent up the dividends of the Suez Canal. It was a new title to superstitious veneration for the founder—*Dieu, protégé la France.* When, therefore, M. de Lesseps holds a meeting of shareholders, they follow him as certain congregations follow a favorite preacher. His report is accepted like a deliverance from the pulpit; it is all unanimity, or the only interruptions are the *malapropos* of gushing gray-haired shareholders, rising to propose medals for him and votes of thanks. He is as impatient of discussion as any other prophet; his call for yeas and nays seems a mere matter of form; his meetings are models of dispatch.

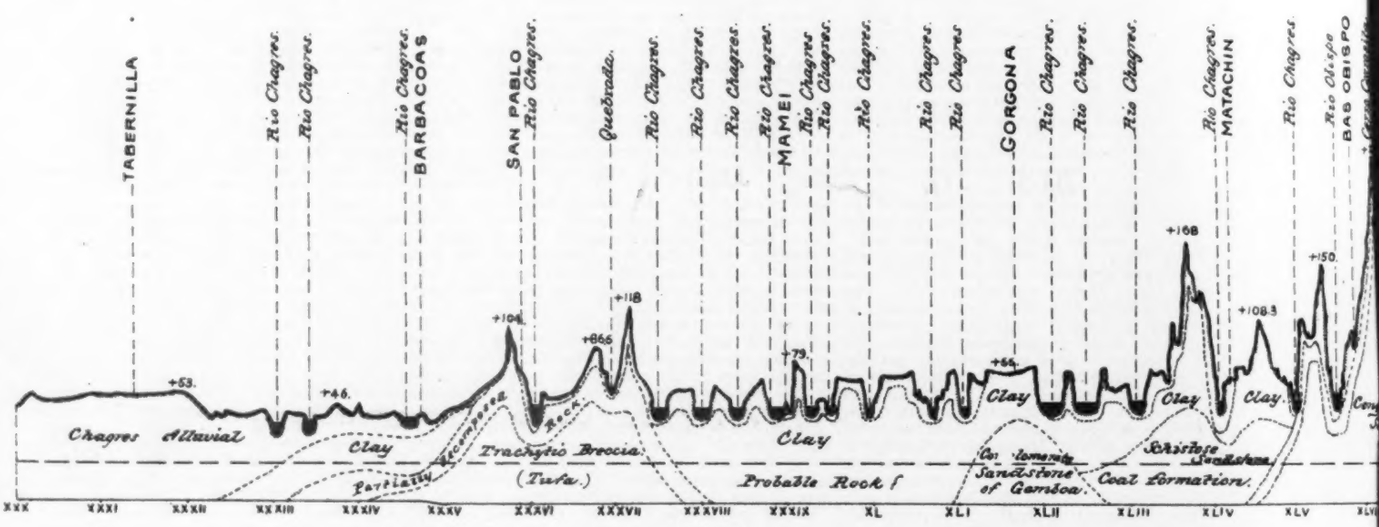
Apart from his power, the French love in him his human nature. He hurried back from London in the very crisis of negotiations, to watch a sick baby, and you may see him any day in the Bois riding at the head of a whole detachment of healthy ones. It is really one of the sights of the Paris row; people look for it as they used to look for the carriage of the Queen of Spain. The cortége goes in a quaint *diminuendo*, from the rather big father on a big horse down to the tiniest daughter on a pony not much larger than a mastiff. If you go to see him, unless on business, and sometimes not then, he will talk about his family all the time, and on the slightest excuse he will lead you out of his study into the large bedroom where they lie, as in the dormitory of a boarding-school, with their beds all in a row. They troop in to meals, they troop in to kiss him in the morning, they troop to lessons and to play. They take a corner of the Tuileries Gardens all to themselves, and run about there with a big dog under the care of two governesses. M. de Lesseps sometimes comes to look at them, forgetful entirely of Suez and Panama.—*Paris Correspondence of the London News.*

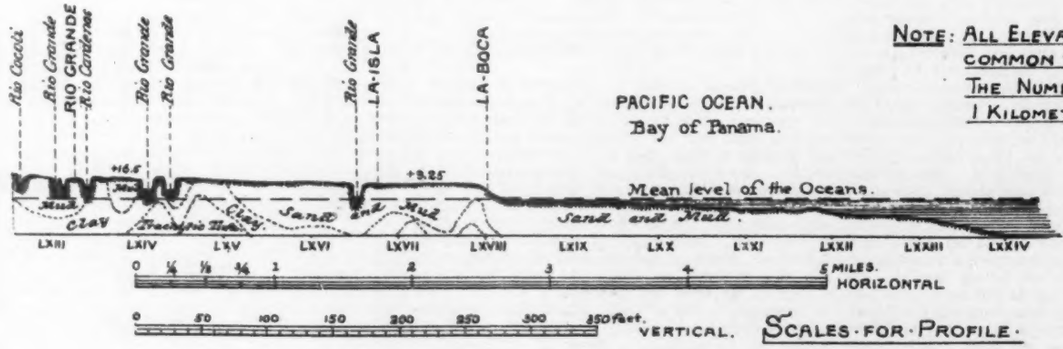
PROFILE AND GEOLO AL

PANAMA CA

From "Le Génie Civil," May 15, 1883.







SCALES · FOR · PROFILE ·

NOTE: ALL ELEVATIONS ARE GIVEN IN FEET ABOVE TH COMMON TO THE TWO OCEANS.
THE NUMBERED STATIONS ARE IN KILOM
1 KILOMETRE = 3.280⅔ FEET.

Memoirs

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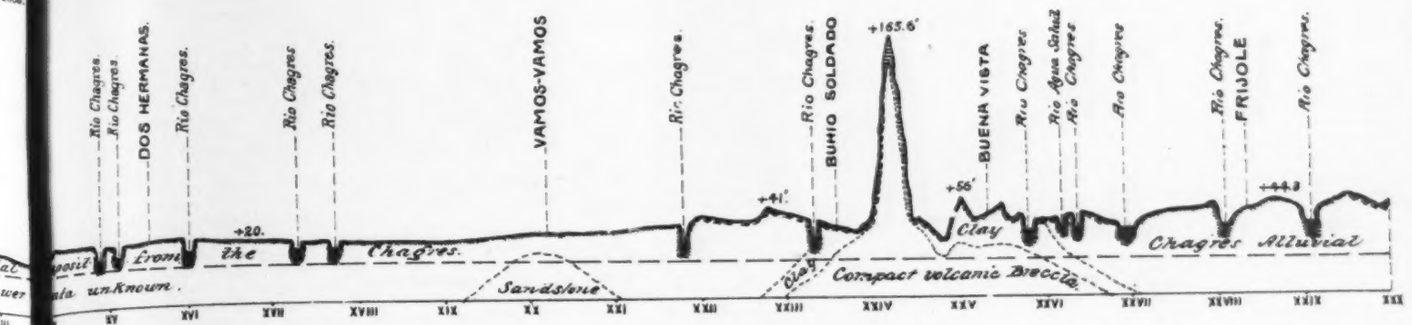

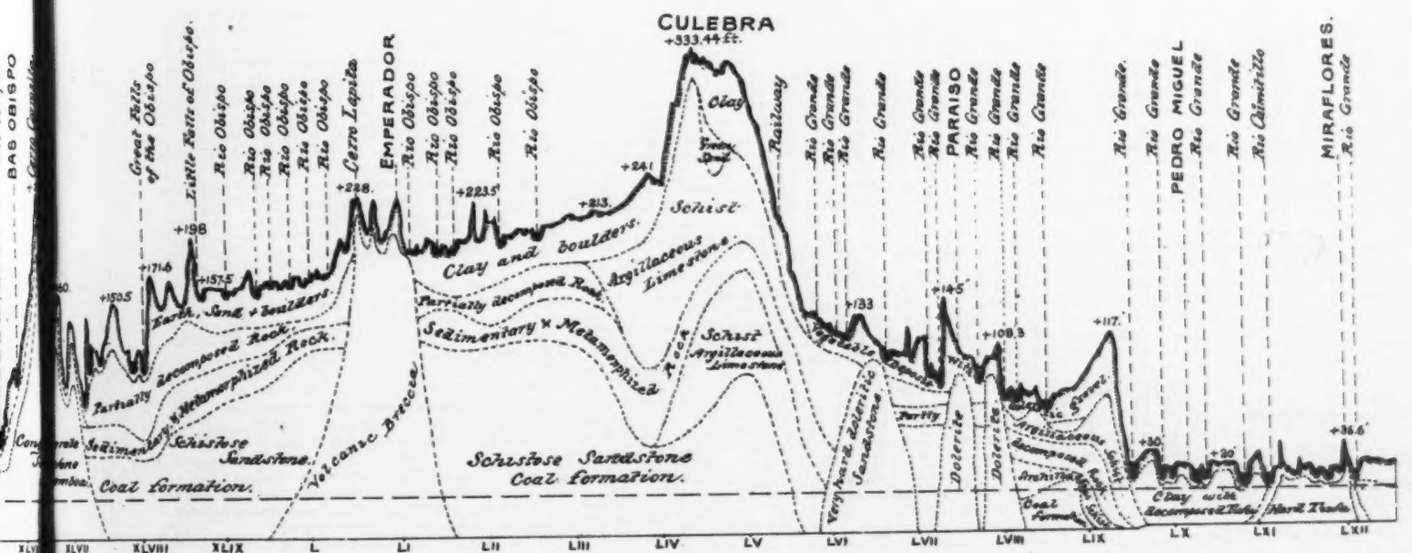

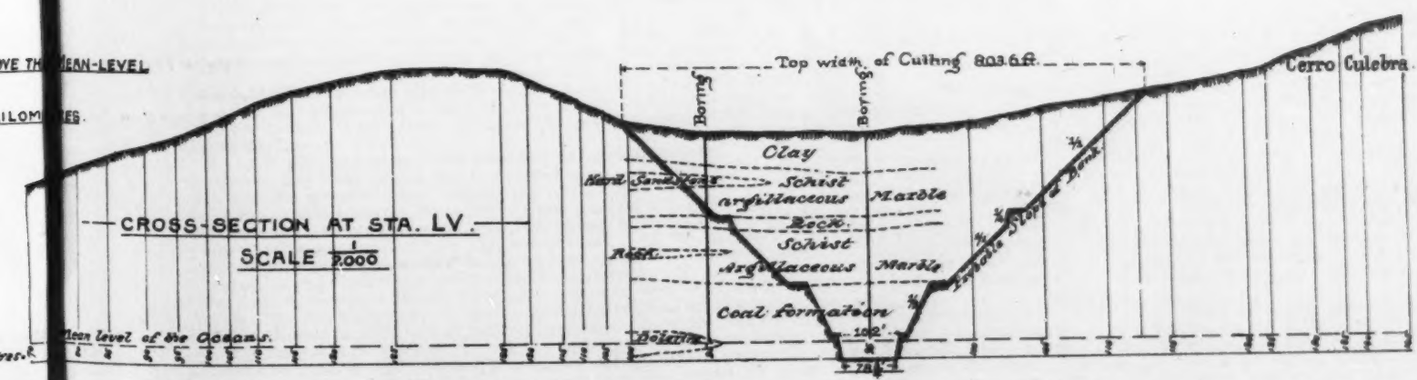

GEOLOGICAL SURVEYS OF THE PANAMA CANAL.

[Translated from Le Génie Civil.]

The geological surveys of the Isthmus of Panama that had been made previous to the last few years did not give that practical information which was required for undertaking such a work as the digging of the canal.

Dr. Moritz and M. Garella, civil engineers, made some very interesting scientific observations in the course of their explorations, but they had no immediate bearing on the present line of the canal. M. Boutan, a mining engineer and a member of the International Technical Committee, was sent to the isthmus in Dec., 1879, and by him we have the first really useful *data* as to the nature of the ground. While we must admit that M. Boutan displayed great mineralogical knowledge, we must state on the other hand that he had not sufficient means at his disposal for thoroughly investigating the strata at certain depths.

The isthmus is completely covered by impenetrable forests, so that the nature of the soil can only seldom be ascertained.

If a few rocks are now and then visible, it is hard to say whether they are outcroppings or isolated blocks, and therefore the nature of the underlying mass cannot safely be judged from an examination of them. The railroad cuttings, the banks of the Chagres and other rivers of the isthmus, which were the principal points of examination by M. Boutan and his predecessors, are of low altitudes and furnish no indication except as to the upper strata. The subsoil and the surface are very much mixed, and the strata encountered by the drill were of such a kind as to surprise the most experienced geologist. At the very spot where M. Boutan believed that a boring was unnecessary, and that the outcropping of some hard rock was a sufficient indication, borings have been recently made to a depth of more than 300 ft., and only a few isolated blocks were met with in a vast mass of sedimentary formations. Thus, scientific deductions and hypotheses had to be dismissed and the revelations of the borer through all the strata had to be waited for.

The commission of 1879 had a few borers, but there was not sufficient time to use them except in a few soft places. The corps which was specially charged with making the borings was formed in February, 1881, and its immediate field of operations was the examination of the big cutting. The *materiel* consisted of the boring apparatus that the first commission had left behind at Panama, and two steam borers.

Several borings were first made in the vicinity of the probable axis of the canal, mostly between Emperador and the Culebra, and these were named after the heads of the Canal Company, such as F. de Lesseps, Couvreux and Hersent, Reclus, Blanchet, Sosa, etc. In addition to these shafts, which varied from 180 to 300 ft., a large number of small ones were made, where the rock lay near the surface. This portion of the canal surveys seemed as if they would be pushed rapidly forward, when certain difficulties intervened.

The general sanitary conditions of Emperador were far from satisfactory, and the site selected for the temporary buildings was a most unfortunate one. The foremen borers and their men had to camp out alongside their work, and being illy provided for, a large number of them sickened and died. The technical management of the service was hardly any better than its material organization. In the first place, the axis of the canal had not been definitely fixed on, and the ground examined might be quite different from those to be excavated.

The *materiel*, too, was insufficient, no cutting tools were included, and the matters that were brought to the surface were merely the crushed substances of the borer, and were of a scarcely definable nature. A good many borings were made in soil that caved in, and as the shafts were not tubed the samples that it was expected came from the bottom were really detached at unknown depths.

The most efficient foremen had been carried off by disease, and their places had to be filled with such material as was at hand. Among the curious designations that some of these improvised foremen gave to the strata met with, was one in these words: "The same ground still." He was so noncommittal that he even omitted to say what kind of ground it was. All these circumstances combined to give very poor results for the first year's boring. The superintendent of the soundings returned to France in 1881, leaving some interesting personal observations to the company, but which formed a very incomplete and incorrect survey of the cutting. A new head arrived from France in March, 1882. He collected all the papers, continued the borings, and had cutting tools made for examining the samples. In a word, he gave an energetic and methodic direction to the work.

The canal tracing having been definitely laid out for a distance of 20 kilometres, new shafts were easily sunk on the line.

The samples were obtained intact, and at well ascertained depths, and could be thus exactly placed on a geological chart. Other apparatus, which proved of the greatest service, came to hand—this was the diamond machine used by an American on contract work. This fact of assistance from Americans and their machines is sufficiently exceptional to deserve mention.

The following will show the cost of boring and the daily advance made during the first two years:

COUVREUX & HERSENT'S SHAFTS (STEAM)—FIRST YEAR.

Average daily advance	0.35 metre.
Cost per running metre	290 francs.

RICHIER'S SHAFTS (STEAM)—SECOND YEAR.

Average daily advance	1.13 metre.
Cost per running metre	55 francs.

DIAMOND DRILL SHAFTS—SECOND YEAR.

Average daily advance	3 to 4 metres.
Cost per running metre	250 francs.

The latter method, despite its heavy cost, is decidedly the most advantageous, for it may be said of the Panama Canal, as of everything else, that time is money. Besides this, the diamond drill gives a series of samples of all the soils without having to adjust a special tool whenever a sample has to be examined. If this kind of apparatus had been in use from the beginning, we should have had known the nature of the soil in the vicinity of the big cut long ago, and the geological survey of the whole length of the canal would have been made.

Besides the central mass, which is nearly surveyed, the region bordering on the Pacific has been bored and examined; two routes for the sea entrance were proposed, and the best position for the dam of the Chagres at Gamboa, etc., was carefully determined. The lower valley of the Chagres yet remains to be explored, as there has been only some isolated borings made, or direct observations of visible strata. These data are sufficient, however, to show the nature of the ground to be dug along the entire length of the canal. We shall make the necessary reserves in doubtful points.

Before entering on a geological description, however, we wish to point out an ingenious system of utilizing the borings. In making deep cuts, the shafts that were put up to determine the axis are taken away at each new layer. The more numerous the successive cuts, the more frequently had the bench marks to be changed; and in order to get rid of this labor, it was decided to have all the new borings, whenever practicable, made exactly on the axis of the canal, and at special points, viz., at the kilometres, the beginnings and ends of curves, and, in fact, wherever the surveying party had placed their staffs of its route. When the boring was finished, a number of old gas pipes joined together were put down to the surface of the canal, thus forming a picket. These become more visible and higher according as the trench advances, and can be shortened as desired. They will stand, too, until the two oceans are joined.

We shall now examine the geological profile of the isthmus following the tracing of the canal. (*See illustration.*)

The canal, on leaving Colon, opens into the Folks River—its sea approach to deep water is hardly one kilometre (1,060 yards). The bottom of the Bay of Limon is composed of a blackish, muddy, and a very shelly kind of sand. Some very hard madreoporite banks are met with, however, and these must be blasted before any dredging can be begun. These shoals are isolated, however, and a canal can be partly made between them that will form a connection between deep water and the canal proper. From kilometre 0, at the mouth of the Folks River to the Mindi Hills, the soil is very soft and boggy. The portion of the mounds of Monkey Hill—seen in the profile—is formed of clayey matters that are readily removed by the excavators. The dredge will work very well throughout this district unless there are too many roots and rotten tree stumps in the ground. There is no cause to complain of tangled roots, however, when they are in soft wet mud, as they prevent the trenching from closing up again, according as it is made.

Between kilometres 5 and 6, the canal will cross the Mindi Hills, or more exactly speaking, a connection between the Sierra Mindi and the Sierra Quebrancha.

A mass of tufa lying below the surface clays will have to be excavated at this point. The upper part of these tufas are rotten, but explosives will probably have to be used for their base.

As we approach the Chagres, we find alluvial soil of the river, sand, gravel and grounded pebbles. At Gatun we come to an extensive formation of compact red clay, such as is met with at several other points in the valley.

Here, the soil, despite its compactness, might be removed by dredging. The banks of the Chagres are almost perpendicular, so that pretty steep inclines might be given to the talus of the canal. The geological data, after leaving Gatun, are rather vague, the more so as we are in a region where the track of the canal has not been yet definitely settled.

M. Boutan, whose opinions are entitled to great weight, except when confronted with data from recent borings, believes that it will be difficult to run the line of the canal without cutting on the right, the base of the Miraflores Wood, composed of sandstone and trachytic tufas, or else the prolongation of the Tiger Hill on the left and a little further on, or finally cutting several small *cerros* that were first discovered in the survey undertaken by the commission of '79-'80. It is only within the last few months that the topography of these mounds has been accurately determined—they rise from a boggy soil, that is inundated a portion of the year, and that is always insalubrious. It is one of the least known and least accessible parts of the isthmus. It will be very difficult to avoid the hard sandstones of Vamos-Vamos, near kilometre 19. It may be expected that a certain quantity of rock will be found beneath the alluvial soil, and the extent and nature of this can only be ascertained by borings.

At kilometre 24, the track cannot follow the meanderings of the river, and must cut through the heights of Buhio-Soldado, and although on the left bank of the Rio, it is very certain that we must excavate rocks of the same nature as those opposite, and on the other side of the Chagres.

In fact there are very extensive quarries in the village of Buhio-Soldado, which are worked by the railroad company. Cut stone of very fine grain, hard, and with no traces of stratification, is extracted. It is very likely that we should have here the first important cutting through the hard rock, with a talus of sharp inclines rising 160 feet above the water level.

Between kilometre 25 and 26—opposite Buena Vista, the ground is not so high, but still the line will have to pass at the foot of a *cerro* belonging to the Buhio-Soldado hill, and at some depth the prolongation of its rocks will doubtless be encountered.

The upper part is composed of a fatty bluish compact clay, to the depth of about 16 ft. on another layer of less fatty yellow clay 16 of ft. A boring was made in 1880, and gave these results, but it was not carried to a very great depth. No boring whatever has been made in the great plain of Frijole and Tabernilla, extending between Buena Vista and Barbacoas. Still the horizontal nature of the ground, an examination of the banks of the Chagres, and the almost moory vegetation of the region would indicate that there are only alluvial matters, sand clay and pebbles, that can be easily removed by the dredge or excavator. M. Boutan made several borings in the neighborhood of Barbacoas (kilometres 34 to 36). On the other hand the strata can be observed here with greater ease than almost anywhere else. The great railroad bridge [illegible] the Chagres has its right bank abutment rest[illegible] on a mass of whitish trachytic tufa of ve[illegible] unequal grain and hardness, but which will nevertheless be somewhat difficult to remove. This rock is visible on the river side as a perpendicular wall of 47 ft. in height. One of the borings, almost over the final track of the canal, met this same rock under a clay layer, then struck argillaceous matter gradually passing into rotten tufa. A little further on, at the San Pablo station, there is an abandoned quarry that shows a greenish trachytic breach along a front some 32 ft. in height—it is very solid and has no apparent stratification.

This mass is on the left bank of the Chagres and about 1,000 yards from the one composing the abutment of the right bank of the bridge. It shows that the river has cut out a passage for itself through a rather narrow clearing. The canal following the same way but more rectilinear in direction, could not but cut the bases of one or the other of these two rocks.

The ground is very uneven from San Pablo to Matachin. The Chagres is very winding in its course and incased between high banks. The soil, especially near the village of Gorgona, is a plastic clay that is very suitable for brick making. As very few borings were made it is impossible to give any decisive opinion as to the lower strata, but the rock is pretty sure to be found at a depth corresponding to 20 or 26 ft. above the level of the sea, and the workshops have been put up on this supposition. It is a pity, however, that we have such vague geological data about a part of the canal that is in process of excavation.

At Matachin (kilometre 44) we come to one of the most important geological points. The Chagres turns at a right angle here, and flows toward the Atlantic. From this point, too, we shall find as we follow the valley of the Rio Obispo, increasing altitudes until we reach the summit—the pass of the Culebra—on the line of the canal. All this mass forms what is termed "the section of the great cut."

Until very recently geologists based their views on the longitudinal profile of this region and the rocky outcroppings on the sides of the cerros, and thus they gave us a geological section in which the underlying rock follows the relief of the ground very closely.

A mass of hard rock was thus calculated on, and it was believed that its greatest height would be at the pass of the Culebra; that it would grow less on the outside, toward the valley of the Chagres on the Atlantic slope, and toward the Rio Grande valley on the Pacific slope.

But the borings that have been made within the past year have proved the erroneousness of such a supposition. The backbone of the volcanic rock is in the region of the Lower Obispo, between Matachin and Emperador. Beyond this latter the strata dip abruptly, and give place to a sedimentary formation of metamorphosed soil, of which the pass of the Culebra is composed. There is every reason, therefore, to suppose that this rocky backbone was formerly the dividing line of the water-shed—the Chagres, in fact, follows it in the upper part of its course—and that the rest is only an old valley forming part of the Pacific slope, but which has been filled up with erosive matters from the neighboring cerros.

According to this hypothesis, the Rio Obispo would have flowed in former times toward the Pacific, and became an affluent of the Chagres by obstruction of the Culebra pass, or some other hindrance on the same line.

The first mass of rock that is found going up the river from Matachin has been termed Gamboa conglomerate sandstone, owing to its being examined for the first time when a site for a dam was being looked for. The rock is marine sediment, as shown by the shells in it, and is composed of an amorphous paste that cements very hard grains, sometimes very close and oftentimes scattered, and about the size of a pea or nut. In the middle of the mass are crystalline calcareous veins. This kind of sandstone not being found in horizontal layers and parallel faces, as is usual in the case of sedimentary rock, must have been upraised by lower eruptive rocks. The surface at present follows the lines of the soil, which is very uneven. The volcanic rock appears at the great fall of the Obispo, of which it forms the vertical wall 45 ft. in height. But the longitudinal profile following the axis of the canal and which runs about 100 yards to the north of the fall, does not meet the rock mass. It is very possible, however, that the cutting of the canal may reach it.

At Emperador, in the cut of the Lapita cerro, we find the volcanic upheaval. It has been bored from a few yards below the surface to the full depth of the canal. The breach contains small veins of various minerals, chalcedony, quartz and red jasper. Its hardness is variable, but always above the average, and it can only be worked by means of dynamite. On both sides of this volcanic mass we find first a thick layer of clay or sand, containing gravel and pieces of rock. The portion lying between Emperador and the Culebra is particularly argillaceous, and the insalubrity of the district is owing to this fact and the extremely flat surface. The water finds no outlet, the ground has no fall, and is so impermeable that there can be no infiltration. Below the upper strata is a bank of rock, which is decomposed and soft on the top, but of average hardness in the lower part.

Finally, at the base, we find an extensive formation of schist and schisteous sandstone, belonging to a coal formation. In the vicinity of the volcanic rocks this coal field has undergone the metamorphic action to such a degree as to acquire a medium hardness. It must be removed by powder blasting. The talus of the canal will keep up if the stratifications are horizontal, as they appear to be, and if the inclines are about one-half. As we remove from the upheaval points, these schists, etc., become softer and more leafy. The samples that are brought by the diamond drill separate of themselves into a series of small, round pieces of a few millimetres in thickness. Stove coal has been hitherto found in only extremely small veins, except in the basin of Matachin, where the field is bounded by two upheavals of Gamboa sandstone.

Some galleries were opened, and coal was found in greater proportion than was indicated by the Emperador and the Culebra borings. Without exaggerating this discovery, it may be inferred that a coal field extends between kilometres 43 and 60—that is to say, from one end to the other of the great cutting, except where it is broken by the eruptive upheavals. Below the Culebra pass is a very large mass of marbled argillaceous schists; it is divided in two by the bank of sedimentary rock already mentioned.

These schists, though hard to extract, when once exposed to air and humidity become soft, and their presence promises nothing favorable. The surface clays have a pocket of running green sand below them which is also a difficulty. Two borings on the same profile through kilometre 55 showed that the strata were horizontal, which is well enough, but the live rock, on the other hand, dips almost perpendicularly. It would be easier to have to excavate this immense trench of 350 ft. in depth, out of a hard, compact mass.

Going down the Pacific slope, we continue to find the same strata interrupted by these dotted spaces: the first formed of very hard sandstone with coarse doleritic grain, the two others of more compact doleritic rock, and closer grained. These dotted spaces are the feet of the *cerros* inclosing the valley of the Rio Grande in the neighborhood of Paraiso.

Finally, the section from Pedro Miguel to the sea is mostly sand, mud and clays. Some of these clays are very compact and are decomposed trachytic tufa, cropping up at certain points, and of which a compact mass is doubtless along the entire distance, but at a greater depth in general than the bottom of the canal.

The line spoken of here is that called "la Boca," because it enters the sea near the mouth of the Rio Grande. Another variation which was located from kilometre 63 had the same hard rocks and in greater quantity and with more elevated points. On the other hand, it had the advantage of giving a good place near the sea for a tide harbor. The Boca line necessitates the abandonment of a harbor, or else its construction more in the interior, where the rock appears near the canal bottom. Foundations at the sea entrance would be almost impossible owing to the silt and soft mud. It may be said that while we can indicate the profiles of the canal in the different soils, we do not know the inclines of the strata with regard to the trench to be opened. The borings have been generally made on the axis. Two others would be required at each of them, from side to side, to have the transverse geological section and thus know the incline to be given to the taluses.

The profiles accepted by the technical commission of 1879 would give a cubic mass of cutting equal to 73,000,000 cubic metres.

From latest surveys—in fact, from the discoveries—it is very certain that the rock cube will be lessened, but that the total cube will be larger, owing to the greater incline that must be given the talus on the greater extent of the line.

The profiles will be very varied, and some of them will have several taluses separated by the necessary banquettes. The total amount of the mass to be excavated may be placed at some 100 millions of cubic metres.

ON THE USE OF CAST IRON FOR HOUSE DRAINS.*

The materials used for the construction of house drains are practically limited to bricks, earthenware and cast iron. The advantages of cast iron are (1), its superior strength and capacity to resist fracture. (2), the greater lengths in which it can be manufactured, the corresponding reduction in the number of joints. (3), the greater facilities for making the joints secure by means of lead sulphur, oxidized iron filings, etc. The points to be considered in adopting cast iron are (a) the available means for preserving it. (b), the determination of the capacity and weight of the pipes. (c), the character of the connections best suited to the material. (d), the nature of joints. (e), the comparative cost. The experience of gas and water companies ought to be a guide as to the life of a cast iron drain pipe in regard to corrosion from the outside inward. When there is no oxide of iron in the soil through which it is laid, the destruction of the pipe from exterior rusting is so slow as to justify its use without any special means of protection. In the case of drain pipes, there is no reason to exclude a good protecting medium because it is poisonous—an objection which, of course, holds good in the case of pipes used for the distribution of drinking water. In addition to the ordinary kinds of paint made from preparations of lead, etc., there are two methods of preserving pipes from oxidation, which deserve more than a passing notice. One of these consists in coating with a preparation of tar, known as Dr. Angus Smith's composition, and the other I refer to is known as the Bower-Barff process, in which the surfaces are covered with magnetic oxide, produced at a high temperature in a furnace built for the purpose. In a letter with which Dr. Angus Smith favored me a few days ago, he mentioned a temperature of 400 deg. F. as the most suitable for the application of his preparation. A certain amount of practice is required in dealing with it, in order to insure the proper consistency of the material when cooled. If it has been subjected for some time to the necessary temperature, evaporation makes the residual mixture hard and brittle after cooling. To avoid this a barrel of oil must be kept at hand to mix with the composition, so as to keep it in its original proportions. If too much oil is added the coating will not be hard enough. I have arranged an apparatus consisting of a trough heated by means of gas jets for applying the mixture, but it is better, I believe, to have the pipes dipped vertically. The use of steam in a double-lined chamber would be an advantageous method of working it, if the temperature of 300 deg. F. recommended is sufficient.

In that case a steam boiler would need to be provided, capable of standing a working pressure of 75 lbs. on the square inch. If 400 deg. F. is necessary, its boiler would require to be able to stand a working pressure of 250 lbs. Before coating cast iron, care should be taken that the surfaces are perfectly free from sand and other foreign substances. A steel wire brush, circular, and provided with a long handle, is useful for scouring out the interior of pipes, and they may afterward be wiped out with an oily cloth. I have here two specimens of Dr. Angus Smith's composition, kindly lent me by Mr. Rawlinson. One of them has been in the ground for twenty-eight years, and though the composition does not seem originally to have been very well applied to begin with, you see that the iron is still in an excellent state of preservation. The other specimen shows the application of the protecting medium in the greatest perfection, and the test of its condition as regards consistency and temperature is to be found in the high glazing or varnish which is given to the surface of the iron when it is properly applied.

The Bower Barff process has recently been brought prominently into public notice. It consists in coating the surface of the iron to be preserved with magnetic oxide. In this exhibition are shown some specimens of pipes treated in this way. They were coated at St. Neot's, Huntingdonshire, under the direction of Mr. Bower, to whom my thanks are due for having done so, for the purpose of this exhibition. I have no doubt of the efficacy of this plan, when the surfaces of the iron to be dealt with are so exposed as to be capable of thorough cleansing. The interior of cast iron pipes require special care in this respect. The "cores" from which they are made being of "green sand," leave rough particles behind them, which, at the high temperature required for the production of the magnetic oxide, must be apt, I think, to form a vitreous glazing, unless the pipes are very carefully cleansed beforehand. To return to the pipes themselves, the diameter I have adopted for ordinary house drains is 5 in. This is the same as has been recently recommended by engineers of the London Sanitary Protection Association. In cases of considerable fall, more especially when the drain is flushed by means of a flushing tank, a velocity of flow is obtained which would be apt to tell severely upon the points of earthenware pipes laid in cement, and considering the first sanitary importance of the rapid movement, this is a point in favor of cast iron. In Lord Ducie's house, in Portman square, the sanitary arrangements of which have recently been altered, there is a direct line of cast iron drain pipe 5 in. diameter and 99 ft. in length, with a fall of 1 in 33. The end nearest the street sewer is provided with a Kenyon air-chamber floor and manhole. At the other extremity of the length of 99 ft. there is a similar provision for inspection, but upon a smaller scale. Beyond this point a further stretch of 5 in. cast iron drain pipe, about 70 ft. in length, passes on to the back of the premises, and is provided with an 80-gallon flush tank. It is found that the velocity of flow between the two disconnecting chambers along the line of 99 ft., first spoken of, is at the rate of 5 ft. per second. As the drain pipe is running nearly full bore, this condition of things renders it impossible that any obstruction in the shape of sewage matter can remain behind. The elements essential to the creation of sewer gas being wanting, its absence from the drain is practically guaranteed. The after part of the flush, in this case, always runs clear. The formulas which are commonly used for calculating the velocity of water in pipes running full must be considerably modified for the flow of house drainage in 5 in. pipes. Taking $V = 140\sqrt{r\,s} - 11^3\sqrt{r\,s}$, in which r is the hydraulic mean depth in feet, and s the sine of the inclination, the rate of flow in the case of Lord Ducie's house drain, already spoken of, in which the length approximately was 99 ft. and the fall 3 ft., the velocity should have been at the rate of 6.22 ft. per second. The difference between this and 5 ft. is what is due to the pipe not running full, and a further allowance must be made for the character of the discharge. I do not think much is to be gained by making the pipes less than 5 in. diameter; and on the other hand, a greater capacity is certainly not required for the purposes of an ordinary household. I therefore look upon it as a useful dimension for ordinary cases. As there is an absence of hydraulic pressure in cast iron pipes used for the conveyances of ordinary house drainage, no extra thickness of metal is required on that account, and they may, therefore, be made thinner than ordinary street mains. The following is a table of the thickness and weight of the pipes of different diameters suitable for the purpose:

Bore inches.	Thickness of Metal. 5/16	1/2	5/8	
4	16.1	22.1	28.3	lbs. per foot.
5	19.8	26.9	34.4	" "
6	23.4	31.9	40.6	" "

In practice, I believe pipes 5-16 in. in thickness are sufficient for drainage purposes, and this would give about 100 lbs. as the weight of a 6 ft. length of pipe 5 in. diameter. Among the various kinds of joints, that known as the "socket joint" appears to me to be the best suited for iron house drains, and although the pipes themselves may be made lighter than main pipes, the socket should not be reduced in weight or strength, because they are subjected to the same strain from the staving of the lead. Great care should be used in this respect, the more so as workmen may be employed who are not so experienced as those in the service of water companies. A joint has been brought under my notice, which has been patented by Mr. Eaton, C.E. It is intended for the use of Spence's metal or sulphur, and consists of an eccentric ring with

*Paper read by Mr. W. D. Scott-Moncrieff, C. E.

a pouring-hole on its top side. This overlaps the joint on both sides, and would be useful, I think, where it was required to insert a length of pipe between two already in position, as this could be done without the necessity of lifting more than the piece which was to be removed. With regard to the connections and appliances suitable for attachment to cast iron pipes, you will see exhibited a cast iron air-chamber floor, which is an effort to simplify the arrangement now so frequently adopted with advantage of having a manhole, with a floor composed of half pipes as a channel for the passage of the sewage, and a trap beyond it to cut off the drain from the main sewer. In the cast-iron substitute for this appliance, the mouth of the trap is practically extended so as to form a floor for the manhole in itself; and this extension has the advantage of affording a provision for side inlets for the passage of surface water and for other purposes. At the further or house end of the drain, instead of building a shallow manhole, a cast iron terminal is provided which is easily accessible, and which is made secure by means of a brass plug fixed in a ground seating of the same metal. In making a connection between a lead soilpipe and an iron socket, it is well to have a strong copper piece, with brazed lap seam, slipped over the lead and soldered. This allows for an oakum and red-lead joint to be made with sufficient substance to admit of calking. As regards the comparative cost of iron and earthenware for house drains, it must be borne in mind that a great proportion of the total expense of lifting an old drain and laying a new one is common to both systems. For instance, the cost of excavating, filling in, and making good is practically identical. The time occupied in making good the joints of an earthenware drain is as six to one as compared to an iron drain, the number of joints being as three to one in the case of 2 ft. lengths of stoneware, and 6 ft. lengths of iron, and I estimate the time occupied to each as two to one in favor of the metal. This, I estimate, balances the extra cost of the material. The connections, including the air-chamber floor, are more costly than earthenware; but this, in the case of an ordinary London house drain, should not amount to more than £5 in all. I think that the greater security to be obtained from the use of cast iron quite justifies the expenditure of this additional sum. These remarks hold good so long as cast iron is to be obtained at its present price. Other kinds of materials are used for house drains, although bricks are now obsolete. The practical objections to the use of earthenware pipes are—1st. Their liability to twist in fixing. Mr. Ernest Turner speaks of having rejected as much as 60 per cent. of pipes supplied by "well-known manufacturers." 2d. Their liability to fracture. Concussion without fracture of the surface is often sufficient to detach a branch piece from a pipe in which the material seems to be continuous, although the connection is often secured by little or nothing but the glazing. As such a contingency may delay a squad of workmen for several hours, until another pipe and branch has been obtained, there is a temptation to make use of defective pipes. Experience shows that workmen are not above yielding to the temptation of concealment. Broken bends and bad connections are frequently found in places which are most available for the passage of sewer gas into a dwelling. 3d. The short lengths in which earthenware pipes are made necessitate an excessive number of joints, in order to make up the length of an ordinary house drain. The joints, when made with clay, are inefficient; and when made with cement, are subject to many drawbacks which nothing but great and uncommon pains on the part of the workman can overcome. The projection of cement to the interior of the joint is a necessary condition, and this must be removed. In doing so, the pipe is liable to movement during the critical period when the cement is setting. The position of a pipe at the bottom of a deep cutting renders it difficult to pack the joint from the bottom. Only a small proportion of earthenware house drains are found to be tight when tested with a pressure of even a few inches head of water. These are among the considerations which have led me to adopt iron in preference to other materials, and I shall be glad if this paper has the effect of calling further attention to the subject.

THE POWER OF WATER.

The properties of water are only partially understood by those who have never seen it under high pressure. The Virginia City Water Company gets its supply from Marlette Lake, on the Tahoe side of the mountain. It gets it through by a long tunnel, is then on the crest of a high mountain opposite Mount Davidson, with Washoe Valley between. To cross this valley by a flume would be almost impossible, so the water is carried down the mountain side to the bottom, and crosses under the V. & T. Railroad track, on the divide between Washoe and Eagle valleys, then up again to the required height in iron pipes. The depression created in the line of carriage is 1,720 feet, and the pressure on the pipes is 800 pounds to the square inch. One pipe is eleven inches in diameter, and is quarter-inch iron, lap-welded, and eighteen feet long, with screw joints. There is little trouble from it; but the other, which is twelve inches in diameter and is riveted pipe, makes more or less trouble all the time. The pipe is laid with the seam down, and whenever a crack is made by the frost or sun warping it, or from any other other cause, the stream pours forth with tremendous force. If the joint is broken open, of course the whole stream is loose and goes tearing down the mountain, but usually the escape is very small. The break last week was less than five-eighths of an inch in diameter, and yet the water in the flume was lowered an inch and a half by it, and the pressure went down fifteen or twenty pounds. Capt. Overton says that fifty inches of water went through it. It has been probably a year in cutting out, and was made by a little stream hardly visible to the naked eye that escaped through a joint and struck the pipe two or three feet off, cutting away the iron until the pressure inside broke it through. When such a break occurs the noise can be heard for half a mile, and the earth shakes for hundreds of feet around. A break the size of a knitting needle will cut a hole in the pipe in half an hour. Such breaks are repaired by pulling a band around the pipe, pouring in molten lead, and tamping it in. Such a stream bores through a rock like a sand blast. The flying water is as hard as iron, and feels rough like a file to the touch. It is impossible to turn it with the hand, as it tears the flesh off the bones, and if the fingers are stuck into the stream, with the point up, the nails are instantly turned black and sometimes torn from the flesh.—*Reno Gazette.*

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 364.)

DLI.—CORNELL UNIVERSITY.

Cornell University, at Ithaca, New York, in lat. 42° 26′ 57″ N., long. 76° 30′ W., is on Fall Creek, near the south end of Cayuga Lake.

The University was opened in 1868, with an endowment of $500,000 from the Hon. Ezra Cornell, and under a charter granted by the State securing to it the income from a grant of 990,000 acres of public lands from the United States government.

Water-works were built by the university in 1875 after the plans and under the superintendence of Prof. E. A. Fuertes, C. E., taking the supply from Fall Creek, which has a water-shed of 30 square miles. The stream is dammed directly above the "Trip Hammer Fall," by a stone masonry dam 15 ft. high, abutting on rock at each end. The wall is vertical on the lower face and battered on the upper. When turbid, the water is filtered through a large wooden box filled with stone-gravel and sand, which is placed in the reservoir near the gate-chamber. The water is pumped to a height of 145 ft. by a Worthington water engine, working under a head of 25 ft., and capable of delivering 72,000 gallons per day through a 4-in. pipe into the reservoir, which is in excavation and embankment, and is 144 by 100 ft. and 21 ft. deep, with the inner slopes covered with 2 ft. of clay puddle, on which is laid a 10-in. stone facing grouted with Fayetteville ordinary water lime.

Distribution is by cast-iron pipe of from 6 to 3 in. diameter, The length of pipe laid is not known. There are 15 fire hydrants, 12 gates and about 30 taps. Service pipes are of lead for domestic use, and of wrought iron for the miscellaneous purposes to which the water is applied around the University. There are 12 professors' houses supplied and 14 University buildings. The daily consumption is 70,000 gallons. Another water engine is in course of erection, of about 150,000 gallons daily capacity.

The works cost $17,000. The cost of operation is not known. The works are in charge of Prof. J. L. Morris, the Superintendent of buildings.

During the construction of the works, delay in the delivery of the pipes, made it necessary to lay in freezing weather a 12 in. and 6 in. pipe through a trench left open in a made embankment at the reservoir. The pipe was laid on a concrete foundation of irregular width, and then covered with bands or rings of concrete, one foot wide and thick and one foot apart. This was then covered with clay, compacted. It has not leaked. The reservoir bank, which was completed in freezing weather, leaked on being first filled, before the walls were grouted. Since the wall was grouted the reservoir has not leaked.

DLII.—KINGSTON, MASS.

Kingston, Massachusetts, in lat. 43° N., long. 70° 40′ W., is on irregular ground. It was settled about 1630.

Water-works were built by a private company in 1804, taking the supply from Cuff's Spring, after plans of Barstow Cook. The spring issues from the side of a high hill, and the water is lifted 100 ft. by a pump of 3½ in. bore and 11 in. stroke, driven by water power, pumping directly into the mains.

Distribution is by 2 miles of pipe of 1¾ in. diameter. The first pipe was of wood. Iron was afterward substituted, and this has been replaced by lead pipe. Fifty families are supplied. There are no fire hydrants. The daily consumption is 3,800 gallons. The population of the town in 1880 was 1,524. The capital stock of the company is $2,500. The annual expenses are $100, and the receipts about $300. Grace Evins is the President, and Henry Hunt, Treasurer.

THE PALESTINE CANAL.

NO. 4 STOREY'S GATE, GREAT GEORGE STREET, WESTMINSTER, S. W., July 17, 1883.

SIR: I have considered the papers submitted to me with reference to making a through water-way communication between the Mediterranean and the Red Sea for ships of the largest class along the depressed gorge of the River Jordan and the Dead Sea by means of two communicating canals, one commencing in the Bay of Acre, to connect the Mediterranean with the northern end of the valley of the Jordan, and the other along the Waddy Arabah, to connect its southern end with the Red Sea.

The northern canal between the Bay of Acre and the northern end of the valley of the Jordan would be constructed across the plain of Esdraelon, and would be about 25 miles in length and, assuming the summit of the watershed between the Bay of Acre and the Jordan Valley to be, as therein stated, only 108 feet about the level of the Mediterranean Sea, and that the excavation for the canal would have to be made principally through chalk and laterite, there would appear to be no engineering difficulties to be overcome other than those necessarily involved in the magnitude of the operations.

The crucial point, however, with reference to the project is that which relates to filling the immense depression in the valley of the Jordan with water up to the sea-level by means of a channel to be formed from the northern end of the Gulf of Akabah, along the Waddy-Arabah to the southern end of the Jordan Valley depression.

To fill this depression with water and to convert it into an inland sea of the same level as the Mediterranean and the Red seas, in a period, say, of three years from the completion of the requisite channel, and to make at the same time due provision for evaporation, this southern channel would have to be large enough to convey over 1,000,000 cu. yds. of water along it per minute during that period.

To pass this quantity of water it is estimated that, with a fall at the rate of 6 ft. per mile, this channel would have to be 480 yds. wide and 20 ft. deep, and it is assumed that a channel of this description may be cut through the loose sand which is said to compose the southern end of the Waddy-Arabah, by means of the properly-directed scour of an elementary channel, having a bottom width of 50 ft. and carrying a solid body of water 10 ft. in depth to begin with.

I do not know what data exist for the assumption that the sub-soil of the Waddy-Arabah consists of loose sand to any great depth, and I believe that, up to the present time, no levels have been taken along it of any reliable character for determining the height or position of the watershed line between the Red Sea and the valley of the Jordan; but, looking at the great interests involved and at the immense importance of obtaining, if possible, a water-way to India independent of the Suez Canal and all its untoward complications, I should advise you to assist the syndicate which has these preliminary questions under investigation as far as lays in your power.

It is impossible to say without further data whether the scheme is actually feasible or not; but should the difficulties be much greater than those anticipated by its promoters, the project is one which, if practicable at any reasonable cost, promises such undoubted financial and commercial advantages that I think it should not be allowed to drop until, after the most searching investigation, it is proved to be impossible. I am, sir, your obedient servant.

HENRY J. MARTIN, M. Inst. C. E.

To Mr. John Corbett, Member of Parliament.

—*London Times.*

THE TEHUANTEPEC SHIP RAILWAY.—The line has been located from Minatitlan to Kilometer 80, on the other bank of the Goatzacoatcos River. The surveys were made by engineers Hendrickson and Hall; these gentlemen have, however, been compelled to resign from ill health. Messrs. Van Brocklin and Thayer finished the preliminary surveys between Tepechillo and Tarifa. Messrs. Thayer and Quien have begun the survey between Tarifa and Salina Cruz. Mr. Corthell of New York, is to draw up the definite plans. Engineer Orr has cleared 33,000 square meters of surface. There is a great scarcity of labor on the Tehuantepec Railway.

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NOTICES OF MEETINGS.

AMERICAN INSTITUTE OF MINING ENGINEERS.

The Autumn meeting of the Institute will be held in Troy, N. Y., during the second week in October. This meeting will be mainly devoted to the reading and discussion of papers.

Members who wish their papers fully discussed at the meeting can have them printed and circulated in advance, if they are sent to the Secretary early in September.

THOMAS M. DROWN, Secretary.
R. W. HUNT, President, Troy, N. Y.

CITY ENGINEER OF TORONTO, CAN.—Applications for this office, made vacant by the death of the late City Engineer R. J. BROUGH, will be received till the 14th inst.

EADS AND THE SUEZ CANAL.—The English promoters of the second Suez Canal are rumored to be conferring with Capt. Eads, with reference to the feasibility of a ship railway at Suez.

THE importance of New York as a port is hardly appreciated. Within a few years it will certainly rank as the greatest in the world, even now closely approaching its rivals, London and Liverpool. The accommodations here are, however, very inferior to those of the English ports, and the great natural advantages have never been sufficiently utilized. A walk along the river front will show the vast and profitable field that there is here for the civil engineer, especially for any one who has seen the magnificent works of Liverpool. The same remarks may be applied to Philadelphia and other cities. With a superabundance, as it were, of fine rivers and harbors, we have not appreciated their worth.

The Dock Department of New York has long been accused of incapacity and want of initiative. Some citizens are now taking up the matter, as far as the East Side is concerned. A meeting of property owners held recently urged the improvement of the East River between Grand and Thirty-fourth streets. Chief Engineer Greene has drawn up a plan for these improvements, but as the cost is estimated at $40,000,000, and as it will necessitate the removal of some important iron works, there is considerable opposition on the part of interested people. General McClellan has a different plan from that of Mr. Greene. The movement is essentially one of real estate owners, and for this very reason promises to be serious and effective.

THE general financial and industrial situation remains this week in about the same condition, although there are ample evidences that in some industries there is undue competition. There is no better founded economical rule than the one that in a certain district where two parties in the same line of business may make a livelihood, they will find this endangered by the advent of a third, who himself gains nothing. It is very well to talk about the survival of the fittest, but the continually increasing ratio of production in this country —including increase of capital, manufactures of all kinds, and of natural products—is altogether out of proportion to the increased ratio of population, or of consuming power. Theoretically, it may be said, that, for instance, our enormous immigration becomes at once a blessing. But in countries, as in individuals, a certain amount of rest is required for assimilation, while nothing in the world is so well balanced as to safely bid defiance to this natural law. Territories cannot become States in a day, nor villages cities. It is true that America has afforded such specimens of rapid growth, and some of the mushroom cities of the oil region and the oil "rage," that once boasted of newspapers, banks, exchanges, etc., have disappeared without leaving much trace behind them.

The immense undeveloped resources of our country seem to afford a grand excuse for every national excess—like one of those immense banyan trees that shelter a thousand people, or the emblematical cloak of charity. It is a part of our duty to try and keep our readers especially posted as to new railway and other enterprises. But, although railroad construction has suffered a small collapse for the present, it must be admitted that the new enterprises—excluding those on paper merely—are sufficiently numerous to provide adequate employment for all our competent railway engineers, while ten times more would not satisfy the "new brood." For even when railway speculators and builders hesitate, and when the general public do not take kindly to building a railway from "nowhere to nowhere," the people of these out-of-the-way places are not satisfied with being "left out in the cold," and one of the first cries of these cities in embryo is for railroads. This comes quite as naturally as "rattles and gingerbread" to children. Though they cannot buy the road, they are willing to subscribe a portion of the cost; they send out deputations, and if they could only have their way, they would involve themselves in the pretty mortgage mess of Elizabeth, N. J.

If a small line cannot be had, these communities are willing to have a smaller line to "tap" some other line. This spirit of enterprise is certainly commendable, but the railway building can be overdone like any other, and it will be better for the real interests of the country not to encourage the aspirations of every small place. The frog that wanted to become an ox simply burst! A little decline in "new" railroads is not therefore any great misfortune.

THE HUDSON RIVER TUNNEL.

All work has been suspended for some weeks on the Hudson River Tunnel. At the New York end the north tunnel has been advanced a total distance of 150 ft., the caisson has been cut through and the south tunnel excavated and lined a distance of 20 ft. This later work is preparatory to an improvement in the previously existing methods of removing material; as understood by our reporter, the intention was to put a horizontal air-lock in the south tunnel similar to the one already existing in the northern section, and then make an open shaft of the caisson. The work of cutting through the caisson was accomplished without any of the trouble experienced originally in starting the north tunnel. This cutting was done and a ten-foot section built in two weeks, and the second ten-foot section completed in eight days.

Col. Haskins hopes to resume work on Oct. 1 next, but nothing definite could be ascertained concerning the future of this important enterprise.

THE AMERICAN TARIFF ON METALS FROM ONE ENGLISH STANDPOINT.

The *Contract Journal* of London, of July 25, makes some very frank remarks (editorially) upon the possibility of an abolition of the tariff on iron and steel by the Americans. It is ridiculous, the editor says, for the English people to work themselves into a jubilant excitement over anything that may benefit the iron and steel trade of England with America; and it must be both amusing and refreshing to the people in the United States to read in English papers that if they—the Americans —will only take off the protective duty on metals, their iron and steel works must be closed, and the English works prosper to an exalted degree. That the United States never has, never can, and never will be able to compete with Great Britain in metallurgy, the editor cites as an equally untrue and absurd, but too common, statement.

The *Journal* seriously questions the wisdom of removing the protective duty, and seems to think that were such the case the position of the Americans as competitors for the world's trade would be materially improved; and England, handicapped by debt, taxation, old customs, and prejudices, made rather inconveniently acquainted with the result.

The *Journal* thinks that a surplus of a hundred millions of dollars in national revenue over expenditures, for the year ending June 30, 1881, is a pretty fair indication of the prosperity of the United States. When the American national debt is paid, an embarrassment of wealth may facilitate the removal of protective duties; "but until the abolition of this debt it would be unwise to look for an utter extinction of protection, and it would be still more unwise to expect that this extinction will prove an unmixed blessing to Great Britain."

CONTRACTOR'S PLANT.

The *Contract Journal*, of London, notes a recent judgment rendered by Mr. Justice Pearson in a case summarized as follows:

The Helston Railway Company accepted a contract with Mr. Maddison, allowing him to sublet any portion of the work. The usual clause in the contract stipulated that all materials, etc., left by or by order of the contractor upon the work should be the property of the company, for the use of the company, and should not be removed without the consent of the company's engineer. A portion of the work was sublet to Mr. Relf, but amicable relations did not continue between the contractors, and the works were suspended till an arrangement was made leaving the question of Relf's plant the only matter in dispute. The company claimed the plant, so did Mr. Relf, and Mr. Justice Pearson had to decide as to the rival claims. He decided in favor of Mr. Relf, on the ground that the only person to whom the clause would apply was Mr. Maddison, the original and sole contractor with the company.

The London *Builder*, in commenting upon this decision, says:

"We are by no means, however, so sure as Mr. Justice Pearson seems to have been that all the equity was on the side of the sub-contractor; for, under this decision, the first contractor has only to sublet the various portions of the work to nullify wholly a stipulation which is put in for the benefit of the employers, and is intended to be acted on. Further, it has to be remembered that presumably the sub-contractor took his portion of the work with full knowledge of the terms of the agreement made between the employers and the principal contractor, and was prepared to stand in exactly the same position as the man for whom he undertook to do a portion of the work. We are not now arguing that the judge gave a wrong interpretation to this particular contract when he held that it did not include a sub-contract in this particular clause. But we desire to point out that justice rather leans to not depriving the employer of his remedy in case of a stoppage of the works, even though those works are being executed by a sub-contractor. The practical result of this decision seems, then, to be that in future employers must have what we may call the plant clause so drafted that it shall apply not only to the principal contractor, but also to sub-contractors. If it is just that there should be such a clause at all, it seems equally right that it should not alone apply to a person who may do but a part of the work himself, or may possibly even sublet the whole."

The *Contract Journal* doubts the wisdom of including the sub-contractor with the contractor in the clause specified, and we agree with the *Journal*. The fewer the parties to a contract, the less ambiguity in interpreting the conditions of the contract; in dealing with principals only there is little trouble in fixing responsibility, and fewer opportunities for shifting this responsibility. The sub-contractor, as the *Journal* remarks, is but a servant to the contractor—the latter fixes prices and pays him, as he would any other of his hired agents; the company should no more recognize the sub-contractor than they should a superintendent on a monthly salary; the only difference in fact between the two agents is that one receives a fixed rate of pay, the other is compensated in proportion to the manner in which the work turns out, and in the degree of experience and skill employed in carrying out that work.

In the case in point, as we understand it, Mr. Relf, the sub-contractor, placed his own plant upon the work, and the company laid claim to it under the conditions of the contract with the principal. It is rather hard on Mr. Relf, we must admit, to decide against the decision of the judge, but it is to be presumed that he took his sub-contract with a full knowledge of the terms of the original contract, and with the understanding that he was to abide by the specifications in their entirety. If the contractor's plant was forfeited, Mr. Relf stood in the place of that contractor, and his individual ownership could not be recognized by the company. In our opinion his only redress lay in a personal suit with the party with whom he made *his*

contract; let him look to his principal for damages, just as he would for his prospective gains in the work to be done.

The whole question is a difficult one, but the simplest way out seems to be the ordinary way—to recognize one contractor, and hold him responsible for the work. How he gets that work done is nothing to the company, and concerns himself alone.

THE NEW CROTON AQUEDUCT.

The Croton Aqueduct Commission met to begin work on Aug. 8. Commissioner Dowd thought a flume four feet square would add 30,000,000 gallons daily to the city water supply, and could be built in six or eight months for $500,000. The Department of Public Works was requested to furnish plans and estimates for the construction of such a flume. The Commissioner of Public Works was also requested to submit plans for the aqueduct and necessary reservoirs and dams, and plans for the immediate construction of reservoirs and dams for the storage of the water of the East branch of Croton River at or near Brewster station, and plan, surveys and maps of the proposed line of the aqueduct.

Commissioner Thompson presented a report in which the proposed dam and reservoir at Quaker Bridge was recommended:

The site selected for the proposed dam and reservoir is the lowest available point on the Croton River and water-shed. It is proposed to build the dam of stone, laid in hydraulic mortar. The stone, which would be undressed, can be obtained from the reservoir site and the neighboring heights. The foundation would rest on bed rock. The highest elevation of water in the reservoir would be 33.83 feet above the top of the present Croton dam. The reservoir would have an area of about 3,635 acres and a capacity of about thirty-two thousand million gallons above the level at which the water is to be drawn off by the proposed new aqueduct. The land required for the reservoir is for the most part sterile. The cost of the dam and reservoir, including land, is estimated at $4,000,000.

The advantages claimed for this reservoir above other suggested systems were:

That it would receive the drainage of the entire Croton water-shed and would accumulate water much more rapidly than a number of smaller reservoirs of equal aggregate capacity higher up in the water-shed on the branches and tributaries of he Croton; that it would secure, in conjunction with the storage already controlled by the city, a daily supply to the city of 250,000,000 gallons of water in the dryest seasons; that its estimated cost was at the rate of $125 per 1,000,000 gallons capacity, while the cost of building the smaller reservoirs in the upper water-shed had been estimated by Allan Campbell in 1879 at $300 per 1,000,000 gallons capacity; that the cost of maintaining the reservoir and guarding it from pollution would be much less than the expense of such supervision extended over many reservoirs scattered over the entire water-shed; that the Quaker Bridge reservoir would render other reservoirs unnecessary for years to come, while if small reservoirs were built, additions would have to be made to meet the continually increasing demand for water; that the area of this reservoir is mostly sterile land, while the sites of proposed reservoirs above the Croton dam cover much arable and cultivated land; that the proposed reservoir would prevent the difficulty which has been experienced in bringing water from the distant reservoirs in cold weather, since both the old and the new aqueduct would be supplied from it.

The line of the proposed aqueduct from the Quaker Bridge reservoir is 31.89 miles long, and is the shortest available route from any point in the Croton water-shed to the city reservoirs; it is only .91 mile longer than an air line.

The report continues:

The proposed aqueduct would be circular in form, 12 ft. clear interior diameter, and would have a capacity of delivering about 250,000,000 gallons per day, being the total constant supply which the Croton water-shed can, with absolute safety, be relied upon to furnish at all times and seasons. The combined capacity of the two aqueducts would, therefore, be 350,000,000 gallons per day, affording opportunity for conveying a large auxiliary supply when needed in the distant future.

Less than six per cent. of the entire length of aqueduct would be embankment, about 92 per per cent. in tunnel (nearly all in rock), and the remainder in excavation. The greatest solidity and permanency of structure, the greatest protection against injury from the influences of weather or from malicious acts, and the least possible cost of maintenance are presented by the proposed plan. The saving in length of conduit effected by tunneling as herein proposed, added to the decreased land damages, will, it is believed, make this aqueduct as economical, in first cost of construction, as an aqueduct of equal capacity built on a line at or near the surface of the ground.

The new aqueduct can be made available in 3½ years, and the Quaker dam probably built in the same time, certainly within five years.

The total distance from Quaker Dam to Central Park Reservoir is 168,400 lineal ft. The distance from the dam to the Harlem River is 140,311 ft., of this 128,956 lineal ft. would be in tunnel—for most part in rock—3,350 lineal ft. in excavation, and 8,006 lineal ft. on embankment. The Harlem River would be crossed by a tunnel 2,320 lineal ft. long. Of the 25,769 lineal ft. between the city end of the tunnel and the Central Park reservoir, 10,186 lineal ft. would be in tunnel. It is proposed to cross the Manhattan Valley by 4,000 lineal ft. of iron siphons. In rock the tunnel would be 14 ft. in diameter to allow for a 12-in. brick lining. From the dam to the Harlem River there would be 35 shafts, of an average depth of 100 ft.

The report closes with the following estimate of probable costs:

Dam and reservoirs, as above stated	$4,000,000
140,311 ft. of aqueduct from dam to Harlem River, at an average of $60 per ft.	8,418,660
2,320 ft. tunnel across Harlem River, at $100 per ft.	232,000
11,986 ft. of aqueduct from Harlem River to Manhattan Valley, at $50	599,300
4,000 ft. of iron siphons across Manhattan Valley, at $93.50	374,000
Gate-houses connected with siphons	100,000
9,783 ft. of aqueduct from Manhattan Valley to Central Park, at $60	586,980
Gate-house and connections to Central Park reservoir	100,000
Four waste gates between dam and Harlem River	30,000
Total	$14,460,940

This does not include land damages north of the Harlem River.

In reply to the Commissioner's request for a plan for the immediate construction of the Sodom reservoir and dam on the east branch of the Croton Commissioner Thompson says:

The construction of a reservoir at Sodom would not be of any material benefit. This reservoir could not be finished but a very short time before the new aqueduct could be made available, and the dam at Quaker Bridge would by that time have attained such height as to impound sufficient water to furnish immediately a large addition to the present supply through the new aqueduct. In case the dam should not have progressed to such height as is reasonably to be expected, the water retained by it could be pumped into thenew aqueduct, or the surplus water which at times flows over the Croton dam could be conveyed to the new aqueduct by a conduit.

The Commissioners ordered that the Department of Public Works' report be printed and then adjourned to August 15.

WATER-WORKS CONSTRUCTION IN 1883.

The following is a list of new water companies, new water-works projected, or of extensions to existing ones, for the seven months ending July 28, 1883, as recorded in ENGINEERING NEWS. We have no doubt there are some more in process of construction, of which we have not heard, but concerning which we would be much obliged for any information whatever:

East St. Louis and Belleville Water Co. (22*); Sedalia, Mo.; Bradford, Pa.; Portsmouth, Va.; New York City; St. Paul, Minn. (35); Brooklyn, N. Y. (36); Worcester, Mass. (48); Uniontown, Pa.; Zanesville, O.; Mattoon, Ill. (58); Spencer Water Company, Spencer, Mass.; Princeton, N. J. (59); Cottage City, Mass. (68); Sharon Water Co., Canton, Mass. (71); Northwestern Water-Works and Gas Supply Co., Minneapolis, Minn. (72); East Saginaw, Mich. (81); New Milford, Conn.; Clarinda, Iowa; Lynn, Mass.; North Adams, Mass.; Winfield, Kan. (82); Roscommon, Mich. (89); Oakland, Cal., Water-Works Co. (95); Boonville, Mo. (96); Cambridge, Mass. (101); Galveston, Tex. (103); Windsor, N. S.; Quincy, Mass. Water Co.; Wichita, Kan.; Faribault, Minn. (107); San Francisco, Cal.; White Plains, N. Y. (108); Durango, Col.; Manzanita Water Co., Cal. 118); East Weymouth, Mass. (132); Battle Creek, Mich.; Denison, Tex. (142); Wabash, Ind.; Franklin, Mass.; Wakefield and Stoneham, Mass.; Southington, Conn. (154); Marblehead, Mass. Water Co. (155); West Bay City, Mich. (165); Huron, Dak.; Connellsville, Pa.; Duluth, Wis. (166); Lewisburg, Pa. (167); Hamilton, O.; Troy, O.; Attleboro, Mass.; Tyler, Tex.; New York City; Brooklyn, N. Y.; and Middletown, Del. (178); Philadelphia, Pa.; South Evanston, Ill. (179); Holland, Mich.; Concord, N. H. (189); New Bedford, Mass.; Naukeag Water Co., Ashburnam, Mass. (190); Staten Island, N. Y.; Portland, Or. (192); Billings, M. T.; Corsicana, Tex.; Fergus Falls, Minn. (201); Powow Hill Water Co. for Amesbury and Salisbury, Mass.; Hopkinton, Mass.; Gainesville, Tex. (202); Forth Worth, Tex.; Brattleboro, Vt.; Willimantic, Conn.; Columbia, Tenn.; Lansingburgh, N. Y.; Safford Springs, Conn. (214); Palmer Water Co., Palmer, Mass.; Newtown, Conn.; Nashville, Tenn. (215); Watertown, Conn. (226); Northampton, Mass.; Cohoes, N. Y.; Revere, Mass.; Newtown, N. J.; Quebec, Can. (238); Beloit, Wis.; Newaygo, Mich. (240); Roanoke, Va.; Des Moines, Ia. (252); Brainerd, Tex. (264); Milton, Sunbury and Lykens, Pa.; Colorado, Tex.; Lowell, Ind.; Hollidaysburg, Pa. (275); Panama Water-Works Co., N. Y. City (276); Temple, Tex. (286); Ft. Collins, Col. (300); Belfontaine, O.; Indianapolis, Ind. (323); Whitehall, N. Y.; West Troy, N. Y. (335); Joliet, Ill. (336); Oshkosh, Wis.; Cleburne, Tex. (344); Haverhill, Miss. (345); Ionia, Mich. (358); Wayne, Ind.; Wyandotte, Kan. (359); Clyde, O.

* Page in ENGINEERING NEWS.

RIVERS AND HARBORS OF NEW YORK DISTRICT.

We make the following extracts from the report of Colonel Newton, engineer in charge of the rivers and harbors in New York District, presented to the War Department on July 31.

Flood Rock and Hell Gate.—During the year ending June 30, the expenditure on the above work has been confined to reducing the roof of the cross galleries to 15 feet thickness, to driving the galleries, and to drilling the large holes for the final blast. Within the year the length of the galleries driven was 204⅝ lin. ft., and 12,202 cu. yds. of stone was removed. The lack of appropriations prevented the employment of an adequate force on the work during the year, and appropriations are now suspended, but the pumping must be continued. Five hundred thousand dollars can be profitably expended in the next fiscal year, according to the engineer's report.

The total appropriation to June 30, 1883, is $3,183,300. It is estimated that $1,963,030 will be required for the entire completion of this work, in accordance with the adopted plans. The unexpended balance of $35,820 will only be sufficient for the care and preservation of the work and the pumpage during the present year.

Buttermilk Channel.—For the improvement of this work $56,356 was expended during the past year; a further appropriation of $20,000 will be needed to complete this work. The amount appropriated to date (July 31, 1883) is $180,000, the amount expended to June 30, 1883, is $119,163.

Harlem River.—$400,000 has been appropriated for this improvement, but as yet none of it has been expended. The work is estimated to cost $1,700,000.

Hudson River Improvement.—The object of this work is to obtain a navigable channel of 11 ft. at low water to Albany, and 9 ft. to Troy; $5,465 was expended during the fiscal year upon this work, and cross dykes were completed at Shad Island and Pepscanee Island. Nine hundred and ninety-seven two hundred and eighty-eight dollars have been appropriated to date for this work; of this sum $16,400 is yet unexpended; $65,102 will be needed to complete the existing project, of which $30,000 can be used in the next year.

Rondout Harbor.—This project includes a prolongation of the channel of Rondout Creek into

the Hudson River by the construction of two parallel dykes, and a branch dyke to direct the current, and protect the north dyke from floating ice. Three thousand five hundred and nine dollars was expended in the past fiscal year; $93,000 has been appropriated to date, and to June 30, 1883. $92,240 was expended; $2,000 is required to complete the work.

Gowanus Bay.—No operations have been begun under the appropriation of $20,000 in 1882, owing to legal formalities pending to secure right of way. It has been recommended to modify the existing project so as to dredge the present channel from Hamilton avenue, Brooklyn, to the southwest corner of Erie Basin, and thus divide it into a north and south channel. This revised plan is estimated to cost $132,565. Sixteen thousand two hundred and eighty-nine dollars was expended during the fiscal year in dredging a channel 1,826 ft. long, 100 ft. wide and 18 ft. deep at low water; $123,000 will be required to complete the improvement, of which $30,000 is wanted next year; $60,000 has already been appropriated for this work, including the $20,000 of 1882; the balance available July, 1883, is $19,876. It is proposed to expend this balance in the present year in widening and deepening the channel of the South branch of the improvement, to doing same for the channel through Erie Basin to Hamilton avenue bridge.

Echo Harbor New Rochelle.—$8,126 was expended in the past fiscal year and a portion of the Sheepshead reef has been removed. The unexpended balance ($3,366) is too small to continue the work on the reef. The original estimate for the improvement was $38,955; $22,000 has been expended, and it is estimated that $16,955 will be required to finish the project.

New Rochelle Harbor.—It was originally proposed here to remove the rocky obstructions and dredge the inner channel from Hunters to Flat Island, at an estimated cost of $40,825; $308 was expended during the year, mainly for surveys. It is proposed to begin in July of present to remove "Corning Rock." The total estimated cost of this work is $5,825 in addition to appropriations made, which amount to $35,000. The a nount available July 1, 1883, was $16,185, and the engineer reports that $6,000 can be expended in present year.

Portchester.—$15,000 was appropriated in 1882 for the removal of sunken rock, at the desire of the business men of Portchester. This money was applied instead to the dredging of the channel of Bryan River. Sixty-nine thousand six hundred and thirty-two dollars will, it is estimated, be required to complete the improvement of the harbor, $27,000 has been appropriated to date, of which $16,925 remained unexpended July 1, 1883.

Raritan River, New Jersey.—There is now at this place a completed channel 1,000 ft. long, 134 ft. wide, and 12 ft. deep at mean low water. Three thousand nine hundred and twenty-six dollars was expended in year; $15,979 remained unexpended on July 1, 1883. This will be devoted in present year to the blasting and removing rocks at Whitehead sand dock, and doing some little dredging in South Channel; $410,000 has been appropriated to date for this work, and $60,000 is asked for for the present year.

South River, New Jersey.—A balance of $3,921 remained on hand July 1, 1883, which will be applied during present year in filling dykes A, B and C with stone. The total amount appropriated for this work is $56,000, and $138,695 will be required to complete this project; $23,000 is requested for the present year.

PURIFICATION OF FRESH WATER.

NORWICH, Conn., Aug. 4, 1883.

EDITOR ENGINEERING NEWS:

How much water must pass daily through a fresh water pond in order that it may not become offensively stagnant. I do not mean for drinking purposes, but as a breeding place for insects, etc.

In case of salt water pumped into such a pond, how much would be necessary. Respectfully, C.

PERSONAL.

MR. ACKERMANN has resigned his presidency of the Illinois Central after a service of thirty-one years. He will be succeeded by Mr. JAMES C. CLARK.

JOHN MCGROGAN, a railroad contractor, was shot and killed at Port Royal, on the Baltimore & Ohio R. R., on the 5th inst., by John F. Moss, a distiller, of that place.

GENERAL W. J. PALMER resigned the Presidency of the Denver & Rio Grande R. R., on Aug. 8. It is generally understood that A. J. CASSATT, late Vice-President of the Penna. R. R., will be his successor.

DANIEL DELANEY, a well-known railroad contractor, while attempting to board a train on the Nickel Plate, at Latta, Ohio, slipped and was crushed by the moving train. He had $3,000 in his pocket.

WILLIAM H. BIXBY has been advanced from Lieutenant to Captain of Engineers, U. S. Army, and transferred from Willet's Point, N. Y. Harbor, to Army Building, New York City, at which place his address now is.

S. B. WHITING, of Pottsville, Chief Engineer of the Philadelphia & Reading Coal and Iron Company, has been appointed to succeed CHARLES PARRISH as superintendent of the Lehigh & Wilkesbarre Coal Company.

A rare case is that of ANDREW CARNEGIE, of Pittsburgh, head of the largest iron manufacturing concern in this country. After accumulating a great fortune he has returned to his native Scotland, and it is said will seek for election to Parliament.

MAYOR LOW, of Brooklyn, has received a letter from the Mayor of Muehlhausen, Thuringia, Germany, informing him that a street in that place had been named after JOHN A. ROEBLING, the first engineer of the Brooklyn Bridge, who was born there.

MR. C. J. H. WOODBURY, the inspector of the mill mutual insurance companies of this city, has had sent to him by the Société Industrielle de Mullhouse of Alsace, Germany, its silver prize medal, in recognition of his recent work on the best means of protecting cotton and woolen mills from fire. It is believed that this is the first time that an American has been the recipient of this award.

SOME interesting details as to army officers are contained in a recent dispatch from Fort Leavenworth to the Kansas City *Daily Times*. The following refers to engineer officers: The senior major on the active list in point of years is EDWARD COLLINS, of the First Infantry, who is fifty-nine. He came into the service in 1846, as a private in the battalion of engineers, and has been in the service ever since. He was promoted from a sergeant of engineers to a first lieutenant of infantry in 1861. F. V. GREENE and CARL F. PALFREY are the youngest captains in the Corps of Engineers. In the general staff of the army the oldest general officer is General HORATIO G. WRIGHT, of the Corps of Engineers, who is sixty-three, and the youngest is General BENET, chief of ordnance, who is fifty-six, and the senior in date of commission.

SOME ENGINEERS have attained very prominent positions. This is especially the case in the Pennsylvania Road and the New York Central. The President of the former road, GEORGE B. ROBERTS, began as a rodman in the Engineer Corps, and was soon made Assistant Engineer in the construction of the Eastern Division of the line. Afterward he occupied positions with various roads; returning however, to the Pennsylvania, he became Fourth Vice-President, and finally rose to President, EDMUND SMITH, the First Vice-President, was engaged as engineer in charge of stations. He became Secretary Treasurer and First Vice-President.

J. N. DUBARRY, the Third Vice-President of the Pennsylvania, began in the Engineers Corps in the construction of the Pittsburgh Division. Upon the completion of this work he was sent to the Western Division of the Pittsburgh, Fort Wayne & Chicago Railroad, to assist in its construction. Upon his return from the West he was made Superintendent of the Northern Central Railroad, and subsequently was promoted to the general Superintendency and Vice-Presidency of that line under the Presidency of Senator CAMERON. After several years' retirement from active railroad work he again entered the service of the company, and was made Assistant to the President, which position he filled until his last promotion.

S. M. PREVOST, the General Superintendent of the Pennsylvania Railroad Division, entered the service of the company in 1871 as Assistant Engineer on the Philadelphia Division. He was afterward transferred to the Bedford Division, of which line he became Superintendent. Then he became Superintendent of the Philadelphia Division, and on October 1, 1882, was made General Superintendent of the Pennsylvania Railroad Division, with head-quarters at Altoona.

AMONG those who took honors at Cambridge last month the name of Mr. LAUPMANN of Peterhouse deserves notice, for he was educated at the Blind College at Worcester, and it is greatly to his credit that in spite of his affliction he should have obtained a place among the Senior Optimes. It is doubtful whether a blind student has ever before achieved such distinction in mathematics.

GREENLAND.

Baron Nordenskjold is engaged on an intensely interesting expedition in Greenland, with the purpose of making a strenuous endeavor to ascertain the character of the interior. Almost the whole of the coast is now known, but, though repeated attempts have been made, no explorer has yet succeeded in penetrating fairly into what may be termed the interior of the country. He does not share in the general belief that the interior is a chaos of glaciers, ice and snow; but argues that it may be an extensive forest or a treeless desert. The prospects of success are not very promising, but no one will think otherwise, than that he, before all comers, is the man for such a forlorn expedition, and every one will heartily wish him good luck.

Greenland is large enough to contain many enigmas and offers the most extensive area for fresh discoveries of any land-masses on the globe. Situated between latitudes 60 deg. and 82 deg. N., its greatest length is upwards of 1300 geographical miles; and its breadth, between longitude 20 deg. and 60 deg. W., must be about 800 miles. Its area is probably not far short of 900,000 square miles; which, compared with that of Australia, is as 3 to 10. From what is known of the meteorology of the coast and surrounding seas of Greenland, it appears that the prevalent winds across the interior must be easterly in January and westerly in July. On the parallel of 75 deg. N., in January, the temperature of the air on the east coast is about 10 deg., and on the west coast about minus 10 deg., or the west is 20 deg. colder than the east in this latitude. This does not support the theory that the winds deposit their moisture on the incoming shores, and leave the opposite shores as dry and warmer winds, as the phenomenon of the *föhn* would require.

In July, on the same parallel, the temperature of the air on the east coast is about 30 deg., while on the west coast it is 40 deg., or the west is now 10 deg. warmer than the east coast; a result equally opposed to the requirements of the phenomenon of the *föhn*, as a general outcome of the prevalent winds. It may be contended that the winds arrive at the interior drier and warmer than they are on the coasts. If so they certainly do not make their exit on the opposite coast warmer, and there is no reason to suppose that the interior air has an ascensional tendency, forming a barometrical depression and escaping as upper currents. The trend of the isobars over this portion of the world precludes any hypothesis of this kind. Provided the interior is an extensive plain at no considerable level above the sea, there is amply sufficient land to cause a large range of temperature between summer and winter. In other words, the climate will be of the continental character, like that of Siberia, a warm summer, and an intensely cold winter. The general opinion is that the interior is mountainous, and at a considerable elevation above the sea, probably an elevated plateau viewed as a whole, and the climates of the litoral seem to support this notion. Scoresby says that "the weather in the months of June and July is found to be particularly fine upon the east coast of Greenland; and the thick fogs with which the adjoining regions are visited seldom remain long at a time on the land. We frequently observed that when there was a thick fog-bank to the eastward the weather was clear near the shore; and, sometimes in stand-

ing to the westward we emerged, as we approached the land, into a clear sky and bright sunshine. The total freeness from clouds of the atmosphere near shore is often remarkable. The sun sometimes sweeps for days together round and round the heavens, without for a moment being concealed by a cloud. The heat on shore is, in such cases, very intense. The constant action of the sun, without the suspension of night, produces an influence on the vegetation which exceeds, perhaps, anything that elsewhere occurs, even in the finest regions of the globe. The whole process of vegetation, from the first mark of vitality in the seed deposited in the ground to the flowering and seeding of another series, is accomplished in a few weeks; and this process, it is evident, must be completed within the limited period in every indigenous plant, or its species would become extinct. The superior heat of the land to that of the sea was most remarkable and striking. When the temperature on shore was not less than 70 deg., the thermometer on board the ship, even near the shore in Scoresby Sound, never rose, I believe, in the shade, above 40 deg."—"Voyage to Greenland," p. 343.

On the west shore, about the same latitude as Scoresby Sound, there is Disco Island with its bays and fjords; and of the climate of that region, extending from latitude 68 deg. to 70 deg. N., Dr. Robert Brown gives the following account in the *Arctic Manuel*, p. 258: "During the winter the country is covered with snow, and the plants are protected under its warm covering. Darkness then covers the whole face of the country for about four months. About May and the beginning of June, according to the state of the season, the earth again begins to appear. By July the snow has generally cleared off all the lower grounds, and only lies in hollows, on the hills, or in places shaded from the sun. From this period until the middle of September, very little snow ever falls, and the climate is mild, and even warm and sunny. A little rain also falls during most seasons. Vegetation springs up apace, and during the long summer day, of four months, soon comes to maturity. By the beginning of August the flowers are on the wane, and by the end of that month have wholly disappeared. The weather of September is uncertain, showers of snow falling, and the nights being dark and cold. By October, bay ice begins to form in quiet harbors or inlets, and the ground gets its winter mantle of snow. The soil freezes hard to the depth of several feet (where it is so thick), and all nature slumbers."

Although fogs are common in Baffin's Bay in summer, there is no great rainfall, so that the prevalent westerly winds are not saturated with vapor, and even if they were, their temperature would not give them a large supply of vapor to carry several hundred miles into the interior. There seems no way of accounting for sufficient precipitation to create interior glaciers, and the probability is that the known glaciers extend only to a limited distance from the coast. With a clear atmosphere inland, the constant solar radiation in summer must be great in heating the surface, and the counter radiation in winter must produce intense cold.—*Engineering.*

AN ELECTRIC RAILWAY.

The electric railway at Wimbledon, which it expected would have carried passengers during the recent rifle association meeting, made a start on Friday, and a train, with Earl Brownlow, Sir Henry Halford, and 18 other members of the association, ran the length of the line, about a mile, at a speed (six miles an hour) which earned for the engineer the congratulations of the party. The experiment has been, unfortunately, a rough one, and the conditions under which it has been carried out are very detrimental to the reputation which the system is susceptible of attaining. The familiar track of light rails laid down 23 years ago, with carriages of the same date, the sleepers loose in the sandy soil, is not the kind of line for an electricity-driven train to be shown off upon, especially when the wheels of the cars are so much furrowed that their bearing surfaces bump on every chair of the rails they pass over. The system of propulsion is by current generated from a Weston dynamo, worked by a 12 horse-power Robey engine, and conveyed and returned by two flat copper bands about an inch broad, each laid at the bottom of a groove in long wood bearers stretched midway between the lines of rails, and supported on square wood blocks saturated with pitch. The insulation seems to be perfect, for when tested by a galvanometer and a battery of five cells not the slightest deflection of the needle takes place. The motor consists of four external magnets coupled together in similar poles, and an armature formed of 16 magnets, traveling in the interval between the external magnets and cutting all the lines of force. It is mounted on one of the ordinary carriages, and the current is drawn off from and returned to the conductors by two trailing chains dropping within the conductor channels. The line was worked partially on Saturday, and again for several hours yesterday. The system has been put under trial by the electric-motor syndicate, the motor being the invention of Mr. Brown. The line is not being worked to the full extent of the power furnished, the engine only making 40 revolutions and the dynamo 300, while the normal rate of the latter should be 900 revolutions. Much greater results, therefore, are to be looked for when the new motor has been further developed.—*London Standard.*

NEWS OF THE WEEK.

THE BAGGAGEMAN.

With many a curve the trunks I pitch,
With many a shout and sally;
At station, siding, crossing, switch,
On mountain grade or valley,
I heave, I push, I sling, I toss,
With vigorous endeavor—
And men may smile and men grow cross,
But I sling my trunk forever!
Ever! ever!
I bust the trunk forever!

I grumble over traveling bags
And monstrous sample cases,
But I can smash the makers' brags
Like plaster-Paris vases.
They holler, holler as I go,
But they can stop me never,
For they will learn just what I know—
A trunk won't last forever!
Ever! never!
A trunk won't last forever!

I tug, I jerk, I pant. I sweat,
I toss the light valises,
And what's too big to throw, you bet
I'll fire round in pieces.
They murmur, murmur, everywhere,
But I will heed them never;
Though women weep and strong men swear,
I'll sling their trunks forever!
Ever! ever!
I'll bust their trunks forever!

—*Philadelphia Star.*

NATCHEZ, (MISS.) WATER-WORKS.—We are pleased to find that our remarks in regard to the construction of water-works in this city have been received with much favor by a very large number of the citizens of Natchez, including many of those who would pay the heaviest tax, if the term "heavy" can be applied to the insignificant addition to our present light taxation, for their establishment. The subject has been pretty thoroughly discussed among the business men of the city, and we learn that a petition will be prepared and circulated, among the taxpayers principally, asking the Board of Aldermen to contract to the best advantage for the construction of works that will furnish a full supply of water for the use of the city.—*Exchange.*

NEW NARROW GAUGE RAILROAD.—Preliminary steps have been taken by a party of capitalists of St. Joseph, Mo., and Doniphan County, Kansas, and two wealthy foreigners, to organize a company to build a narrow gauge railroad from St. Joseph through eastern Kansas, across the southwestern corner of Missouri, into Arkansas, and ultimately through Louisiana to the Gulf of Mexico. The company starts off with a capital of $2,500,000, and will begin operations at once.

THE GILPIN COUNTY (COL.) WATER SUPPLY CO. is incorporated for the purpose of introducing water from Fall River and Silver Creek into Nevadaville, Central City and Black Hawk for domestic, fire and milling purposes. John Lockwood, gas and hydraulic engineer, 52 Broadway, N. Y., has the contract at $1,100,000.

PROPOSED BRIDGE AT PORT DEPOSIT, MD.—The Board of Public Works of Maryland visited Port Deposit on Aug 3, to examine the site of the proposed Balt. & Ohio R. R. bridge across the Susquehanna River.

THE PENNA. R. R'S. SCHUYLKILL VALLEY BRANCH.—The grading of the entire western section as far as the Manayunk Bridge is nearly completed, temporary bridges have been built, and 3 miles of track laid.

THE PARAMORE RAILROAD SYSTEM.—ST. LOUIS, Aug. 4.—This system was opened to-day throughout its entire length of 723 miles, connecting Bird's Point, Mo., with Galesville, Texas.

A NEW BRANCH FOR THE ERIE.—A corps of engineers are now surveying a new route from the N. Y. & Greenwood Lake R. R., at Montclair, through Whippany, Troy, Hanover Neck and Caldwell, to Morristown, a distance of 12 miles. This road will shorten the time from New York to Morristown from one hour, the present time, to forty minutes.

OTTAWA & GATINEAU VALLEY AND OTTAWA COLONIZATION RAILWAYS.—The contract for the construction of the Ottawa & Gatineau Valley Railway has been awarded to Messrs. Macdonald, Bray & Jones, of Toronto, and work will proceed about the first week in August, the entire line to Desert to be finished within three years. The Ottawa Colonization Railway will be under construction within a few weeks and vigorously prosecuted thereafter.

A CUBIC INCH OF GOLD is worth $310; a cubic foot, $363,380; a cubic yard, $9,797,762. This is valuing it at $18 an ounce. At the commencement of the Christian era there was in the world $427,000,000. When America was discovered it began to increase. Now the amount of gold in use is estimated to be $6,000,000,000.

THE BOULDER OF THE FLUME.—From surveys and calculations made by J. A. Farrington, Civil Engineer, the famous Washington Boulder, near Conway Corner, N. H., is found to measure 30 ft. in height, 46 ft. in length, 35 ft. in width and to weigh 3,867 tons. This is the largest known isolated piece of granite in the world.—*Granite Cutters' Journal.*

THE BRIDGE ON FIRE.—At six o'clock, Monday afternoon, the East River Bridge was discovered to be on fire. A lighted cigar stub had started it, and it had burned half through a plank before it was discovered. It was easily extinguished.

TWO YOUNG MEN were clerks in their father's store. One lived in the parental house free of expense, and the other was paid a salary. The former sued for compensation, and offered to prove the value of his services by the amount paid to his brother. In this case the Supreme Court of the District of Columbia decided in favor of the father, saying that unless there is an express contract to pay a son for services where he works for his father, who is boarding and lodging him without charge, he cannot recover compensation. The law will not imply a promise to pay him, and, if a recovery could be had, what was paid to the brother would be no evidence of his services' value.

GLENWOOD (MINN.) WATER-WORKS.—The contract for digging ditch for laying water pipe was awarded on Monday, the 30th ult.

BRIDGES NOT ACCEPTED.—EAU CLAIRE, WIS., Aug. 3.—A local committee of experts examined the three new bridges constructed across the Chippewa during the past winter and spring, and pronounced each and all of them as being far short of fulfilling the specifications called for in the contract, and recommended that they be not accepted by the council. A special meeting is called for Saturday evening to consider the question.

THE ASHTON-MITCHELL BRANCH.—The construction train of the Milwaukee & St. Paul on the Ashton-Mitchell extension has arrived in Redfield, Dak., and is now at work between that place and Woolsey. Engineers are running the survey of a line running from Redfield to the Missouri River. The main line starts from a point a half mile north of Redfield, and bears almost directly west. It is thought that this line will eventually be the main line of the Northwestern between Chicago and the Black Hills.

THE PROPOSED COVINGTON (KY.) WATER RESERVOIR is meeting with a great deal of opposition. The cost is estimated at $200,000.

THE "FRISCO" & ST. LOUIS LINE has all its bridges in working order again. The new bridge over the Arkansas is built, and the bridge over Spring River, that had been destroyed, has been replaced by an iron structure of two spans of 100 ft. built by Rust & Coolidge.

THE CONTRACT FOR $100,000 WORTH of work on the New Pan Handle shops at Columbus, Ohio, has been given to Sellsby, Kramer & Kohn, of Toledo.

A ROAD FROM APPLETON CITY TO RICH HILL (KAN.) will probably be built. A meeting was recently held at the latter place, at which S. J. Emerson, engineer of the St. L., E. & W. Railway was present and he was ordered to begin a survey at once.

THE ROB ROY BRIDGE, at Pine Bluff, Ark., was opened August 4, and thus the Texas & St. Louis Railroad is completed.

THE ST. JOSEPH & JOPLIN GULF ROAD has been organized at St. Joseph, Kansas, with a capital of $2,500,000. A survey will be made at once. It will run through some of the best land of Arkansas and Texas.

THE CLINTON GAS COAL AND COKE CO. was rerently incorporated at Jefferson City, Mo. The capital is $50,000.

THE JACKSONVILLE, TAMPA & KEY WEST is now graded between Jacksonville and Palatka.

THE DECAY OF THE SPRUCE.—There is uneasiness about the decay and death of spruce in Northern Aroostook, and Mr. F. B. Hough, of the U. S. Forestry Department, is to investigate the subject. The general opinion seems to be that the trees are dying from old age; others attribute the cause to climatic change.

DOOFLICKER'S RIDE.—"Yes," said Mr. Dooflicker, as he drew his chair out on the porch, to the family circle, "I had some wild experiences when I was a locomotive engineer. I remember one night I was ordered to take a doctor from Chicago to Mendota in the quickest possible time. To make my engine lighter, I uncoupled the tender and left it on a side track. When the doctor took a seat on the fireman's box I threw the lever down in the corner and gave her steam. Away we

jumped like a scared kangaroo. The doctor's eyes bulged out like a pair of porcelain door knobs as we hustled over the prairie toward Riverside.

"'What's that—a post?' asked the doctor as we passed something in a jiffy.

"It was a coal shed 120 feet long. So you can see how fast we are going."

"'What's that funny-looking fringe on our left?' asked the doctor.

"'Them's telegraph poles,' answered the fireman as he stopped half a minute from shoveling coal, just as we zipped through the shop-yards at Aurora.

"Well, we made Mendota, without a stop, in forty-one minutes and a half—just two miles a minute, and I boiled the coffee in my dinner pail on the driving boxes."

"What a long-armed fireman you must have had, pa," put in young Theophilus Doofficker as he looked up from a copy of Æsop's fables that lay on his lap.

"How's that?" asked Doofficker.

"Why, to shovel coal in Aurora from a tender that stood on a side track at Chicago."

Doofficker went into the house.—*Chicago Herald.*

HERR SCHELL, of Grund, Germany, has reported that in the course of mining operations in the Hartz Mountains, the sounds made by the firing of shots in a cross-cut were audible through the rock at a point 437 feet distant in a horizontal direction; and the dropping of a 330-pound stamp on the surface was heard in a tunnel through 571 feet of rock, the tunnel being 538 feet below the surface and under a point distant horizontally 187 feet from the stamp mill.

A NEW KIND OF GUNPOWDER.—Himly, in his efforts to discover a new kind of gunpowder that should possess more power than the ordinary powder, without the dangerous properties of the nitro-compounds like dynamite and that class, found that the best results were obtained with a mixture of saltpeter, chlorate of potash, and a solid hydrocarbon.

The new powder is made by mixing finely pulverized saltpeter, chlorate of potash, and coal tar pitch with enough benzol (from coal tar) to make a plastic paste or dough. This is formed into flat cakes by pressing it into molds, and the benzol allowed to evaporate. The cakes are then granulated like any other gunpowder. Like ordinary powder, the grains are irregular and can be made of any desired size. Its specific gravity is 0.9, or a little more, agreeing with common gunpowder.

It is quite hard, and does not smut even when damp. It will bear a heat greater than that of melting tin without change. It will not ignite by a single spark of short duration. If ignited in an open vessel, it burns rapidly with a white light. In a closed space it burns violently, and leaves behind a slight residue, producing but little smoke. A gun is not injured in the least by the products of its combustion.

The advantages of this powder over those previously in use are essentially the following:

1. Ease and rapidity of manufacture.
2. There is no danger in making it.
3. Its freedom from any hygroscopic qualities; 100 grammes of it exposed to damp weather for four days in an open window showed no gain of weight with a delicate balance.
4. It is two and a half times more powerful than common powder,
5. The slight residue, leaving scarcely anything.
6. The fact that it gives off so little smoke as to be scarcely noticed, and what is formed is totally innocuous as contrasted with that from nitro-explosives.—*Repert. Analyt. Chemie.*

STATEN ISLAND RAPID TRANSIT CONTRACTS.—Bids were received at the office of the Engineer of the Staten Island Rapid Transit Railroad, in this city, up to noon Thursday, for the construction of the road from a point on the northwest corner of the island opposite Elizabethport, N. J., to Peteler's Hotel, on the South Beach, below Vanderbilt Landing—a distance of about 13 miles. Twenty-four proposals for the work were made, 14 of which were for the building of the entire road, and the remainder for building sections of it. A meeting of the Board of Directors will be held next Wednesday, when the contract will be awarded. It is expected that work on the road will begin about Sept. 15, and that the line will be in operation about Sept. 1, 1884. The right of way is now being bought between Tompkinsville and Vanderbilt Landing.

BIG MINING AND OTHER SCHEMES IN CALIFORNIA.—There are at present in Oroville our former Congressman, the genial John K. Luttrell, and the eminent engineer, A. W. Von Schmidt. These gentlemen are there in the interest of a huge mining scheme, which contemplates the turning of Feather River, the mining of its bed for several miles, the mining of Carpenter's Flat to its bedrock—which has never yet been favored—and the establishment of a vast power sufficient to turn all the manufacturing machinery in the State and supply Marysville, Sacramento, Stockton, San Francisco and intermediate towns with water; that is, they can do all that if they can build a dam that will stand the flood pressure of the Feather River. We have not heard the opinion of Mr. Von Schmidt on the proposition, but as he is an eminent engineer, who has been successful in all that he has undertaken, we should regard it as practical, however doubtful it may be about its proving profitable as a mining operation. A dam to hold the waters of the Feather River will cost a large sum, and the question to be considered is whether sufficient can be realized to render the work profitable after the practicability of the work has been decided upon.—*Chico Record.*

THE QUINCY (MASS.) WATER COMPANY.—At a meeting of incorporators of this company, held at residence of Dr. Gordon, the 2d inst., an organization was effected, and the following gentlemen elected: Charles H. Potter, President; Dr. W. L. Faxon, Clerk and Treasurer; Charles H. Potter, John A. Gordon and W. L. Faxon, Directors. The proposition of W. C. McClallan, of Chicopee, to build the works was virtually accepted, and the contract will be put into shape as soon as possible. The plan embraces the laying of over twenty miles of pipe, the largest of which will be twenty inches inside diameter. Work will be begun as soon as material can be delivered.

CANAL CONTRACT LET.—The contractors, J. C. Rodgers, of Poughkeepsie, New York, and E. Farrell, of Montreal, Canada, have begun work on a large contract lately awarded them by the Dominion government of Canada, namely, basins Nos. 3 and 4 of Lachine Canal. The work consists of the formation of two new basins near St. Gabriel locks, and will be chiefly earth excavation and stone masonry. It is to be completed by September, 1884. These basins will add very much to the shipping interests of Montreal, as the present basins 1 and 2 are not equal to the demand of shippers for vessel berths for the loading and unloading their freight.

A NEW TELEGRAPH COMPANY.—The New England Telegraph Co. was incorporated on Tuesday in New York. The line is to run from New York to Bangor (Me).

BIDS FOR THE CONSTRUCTION of the Michigan, Indiana & St. Louis are being received at Vincennes, Ind. The road will be 170 miles in length and runs from Sturges, (Mich.), to Danville, Ill.

THE SURVEYS of the lower route of the Vincennes & Ohio, from Vincennes to White River have been completed. The engineers are now surveying the upper route, which runs through Monroe City.

THE GEORGIA PACIFIC is nearly completed. Two spans of the Cross River bridge have been finished.

THE CINCINNATI NORTHERN EXTENSION has met with a great deal of opposition from property owners. The design was to extend the tracks by elevators to Fifth street.

DISCOVERY OF A WONDERFUL CAVE.—CHATTANOOGA, Tenn., Aug. 9.—Explorations of a recently discovered cave at the base of Lookout Mountain, opening at low water on the edge of the Tennessee River, three miles from this city, have developed a wonderful cave of unknown depths. At the extreme point of exploration a very large lake was encountered, into which a fall 150 feet high poured its waters with a noise like thunder. Many other interesting phenomena were also discovered.

THE GRAMME PATENT IN COURT.—PROVIDENCE R. I., Aug. 9.—In the United States Supreme Court, at Newport, to-day, Judge Blatchford presiding, the case of the Gramme Electrical Company, of New York, against the Arnoux & Hochhausen Electric Company is being argued. This is a suit for infringement of a patent granted to Zenobe Theophile Gramme, of Belgium, in 1871, he being the inventor of the modern dynamo machine. The complainants allege a general infringement of substantially the same services. The case involves very occult scientific questions, and has been in controversy among electricians for many years. The machines are exhibited in court.

CHIEF ENGINEER LUDLOW, of the Philadelphia Water Department, has now twenty inspectors.

THERE was a scarcity of basalt blocks lately in San Francisco, and Contractor McDonald was called upon to furnish them. The price had risen from $36 to $50 per 1,000.

THE people of Walla Walla (Wash. Ter.) are trying to induce the Union Pacific to extend its Oregon short line to that point.

A NARROW-GAUGE LINE from Jasper (Ind.) to Orleans is about to be surveyed.

THE INCANDESCENT LAMP IN LONDON.—Colonel Haywood's report on the incandescent lamps on the Holborn Viaduct gives the illuminating power of the lamps as about 1¼ times that of the ordinary gas lighting of the Viaduct, and at the same cost. The observations extend over twelve months, during which the total number of failures from defects in machinery and carbons was equal to about 0.3 per cent.

FAST RAILWAY TRAINS.—The fastest train would now appear to be the new Manchester-London express, run by the Manchester, Sheffield & Lincoln Company via Sheffield and Grantham. The distance is said to be 175 miles, and the time has been reduced to 3 hours 25 minutes, probably to be still further reduced to 3 hours 15 minutes, which will give an average of about 54¾ miles an hour. What is the actual distance of Sheffield?

The following statements in regard to other fast trains are taken from the little book published by the Boston & Albany Railroad Company and circulated among passengers on the Springfield line to Boston.

Flying Dutchman, on Great Western Railroad, London to Exeter, 194 miles, 4 hours 14 minutes, with four stops, almost 46 miles per hour.

Express on Great Northern. The Leeds express makes distance from London to Leeds, 187 miles, in four hours, almost 47 miles per hour, with four stops.

The Irish mail, London & Northwestern, once called the Flying Irishman, a little less than 40 miles.

Morning express, on Great Northern Railroad London to Edinburgh, 395 miles in 9 hours. An average of almost 44 miles per hour.

The Midland line, Scotch express, London to Glasgow, 525 miles, 40½ miles per hour.

These are the five fastest trains in England, the Leeds express with its 47 miles per hour being the fastest.

The train leaving Boston at 4½ P. M., via Boston and Albany, for New York, makes the run of 234 miles in six hours, making twelve stops, averaging three minutes each, which makes the actual speed of this train forty miles per hour.

WOOD PAVEMENTS are to be given up in London. It has not only failed to realize the promised advantages, but has led, according to Prof. Tyndall's report, to serious affections of the eyes and lungs. By continual watering the wood became saturated with the nastiness of the London streets, and then, under the influence of the hot sun, gave forth a species of dust which was pernicious. The old macadam system is to be restored.

KANSAS CITY people are undecided as to the relative value of Medina, Sioux City or Fort Collins stone, or of wood for street pavement.

LABOR IN MICHIGAN AND OHIO.—The Michigan & Ohio Railroad Company want all the men they can get, shovelers, tracklayers, etc. The wages range from $1.50 to $2 per day, payable the 15th of each month for the preceding month.

THE ROCKRUN (O.) EXTENSION OF THE BALTIMORE & OHIO is begun. David Davis, one of the Columbus and Eastern contractors has the contract.

THE SURVEYING CORPS of the McConnellsville & Pittsburgh line are locating the line between Zanesville and McConnellsville. The Muskingum River Packet Co. refused to tow the engineer, and a boat from the Ohio was used.

THE BURLINGTON, CEDAR RAPIDS & NORTHERN is to be extended from Worthington, evidently with Bismarck in view. The survey will be made this week.

THE GEO. F. BLAKE MANUFACTURING COMPANX.—This firm has just issued a trade catalogue that in excellence of typography, fullness of information, and general appearance is a model catalogue; it stands unexcelled.

Engravings, equal to steel in finish, illustrate the many specialties manufactured by this company; and particular attention is called to their improved Duplex, Artesian, Brewers' Air, Sinking, and Vacuum Pumps, and the Air Compressors built by them. A new feature in this edition is a few pages of useful information concerning water and steam; and there is also a telegraphic code for ordering pumps or parts of pumps.

Copies can be had by applying to the company's office, Nos. 95 and 97 Liberty street, New York, or No. 44 Washington street, Boston.

THE MISSOURI RIVER has been cutting and shortening its channel for years. The course of the river has been very capricious, working between bluffs. This is particularly the case in the neighborhood of Sioux City. Only stone levees can be of any service. Brush and wire levees are of no use. An old captain maintains that the day for long steamboat trips is over, owing to the competition of railroads. The inundations also do harm by spoiling the crops and leaving no cargoes.

THE LOCATING OF THE COLUMBUS, HOPE & GREENSBURG RAILROAD will be begun at once. Chief Engineer Prother lately arrived at Columbus with a corps of engineers.

CHANGES IN ORGANIZATION OF NORTHERN PACIFIC RAILROAD.—The following changes are hereby made in the organization of the operating departments of the Northern Pacific Railroad, the same to take effect this date.

J. T. Odell is appointed Assistant General Manager of the Eastern Divisions, to include all branches and leased lines east of Helena, Montana.

The charge of J. M. Buckley, Assistant General Manager of Western Divisions, is extended to

Helena, and includes all branches and leased lines west of that point. Office at New Tacoma, W. T.

John Muir is appointed Superintendent of Traffic for the whole line. Office at St. Paul, Minn.

The Assistant General Managers are authorized to approve all requisitions, pay-rolls and vouchers on the divisions under their charge, and perform the ordinary official duties of the General Manager.

They will, unless otherwise ordered, supervise and direct the operations of the Transportation and Road Departments, and receive reports from all officers connected therewith.

The Machinery Department for the whole line will continue as heretofore under the charge of G. W. Cushing, Superintendent of Motive Power, Machinery and Rolling Stock, who will report to the General Manager.

The operating divisions east of Helena will be consolidated into three grand divisions, as follows:

The first grand division will embrace the Minnesota Division and branches, including the St. Paul & Northern Pacific; the Northern Pacific, Fergus & Black Hills; the Little Falls & Dakota; the Wisconsin Division, and such other branches, extensions and leased lines as may be connected therewith.

The second grand division will include the Dakota and Missouri Divisions, the Fargo and Southwestern, the Jamestown and Northern, and other branches and extensions to be constructed hereafter.

The third grand division will include the Yellowstone and Montana Divisions, the National Park Branch, and other branches to be constructed.

M. C. Kimberly will be Superintendent of the first grand division. Office Brainerd, Minn. A. E. Law and W. D. Simpson, Assistants, with offices at St. Paul, and Fergus Falls, Minn., respectively.

J. M. Graham, Superintendent of second grand division. Office Fargo, D. T. A. L. McLeod, Assistant, in charge of Missouri Division, vice D. R. Taylor, resigned. Office Mandan, D. T.

S. R. Ainslie, Superintendent of third grand division. Office Glendive, Montana. F. L. Richmond, Assistant, in charge of Montana Division. Office Livingston, Montana.

This consolidation of divisions will affect only the general supervision. All accounts, pay-rolls, vouchers, etc., must be kept separate and distinct for each division as heretofore, and especial attention must be given to the distribution of accounts in order that the operating expenses of each division may be separately and accurately determined in accordance with instructions heretofore given.

Uniformity in rules, regulations, signals, forms and accounts must be insisted on, and no Division Superintendent or other officer will be permitted to vary from established standards in construction or operation without the approval in writing of the General Manager.

Approved: H. HAUPT, General Manager.
T. F. OAKES, Vice-President.

PAVING CONTRACTS.—Richard West and Messrs. Farley & Patterson have been awarded cedar block paving contracts, in Toronto, Canada. Prices were 65, 79, 80, 83, 85 and 95 cents per square yard, for paving, and 24 and 25 cents, for curbing, according to location. Sixty-five cents was where present road-bed was used.

THE DUTY ON THE PORTLAND CEMENT imported for the construction of the Bartholdi pedestal has been remitted. It footed up to $5,000.

RAILROAD BUILDING IN NORTH CAROLINA.—Seven roads are now in course of construction in the State of North Carolina, viz.: Cape Fear and Yadkin Valley, Chester and Lenoir Narrow Gauge, Western North Carolina, Ducktown Branch; line from the Raleigh and Gaston Railroad to Warrenton; from Richmond, Va., to Ridgeway, from Trenton to Core Creek with Atlantic and North Carolina Railroad; North Georgia through Macon County.

THE SALINA WATER-WORKS.—SALINA, Kan., Aug. 6.—To-day a public test of Salina's Holly water-works was made. A large number of citizens witnessed the display, which was perfectly satisfactory. Six streams were played at once, averaging 100 feet in height. A firemen's tournament, at which a more formal inauguration of the works will occur, has been agreed upon for October 1, one of our county fair days.

LARGE LUMBER FAILURE.—Brown' Bros. & Co., of Detroit, have failed with liabilities of $100,000.

A PROPOSED VANDERBILT LINE TO THE WEST.—A dispatch from St. Louis states that General J. H. Devereux, President of the Bee Line; John Tillinghast, of the Vanderbilt roads; George W. Parker, Vice-President of the St. Louis, Alton & Terre Haute Railroad; Colonel J. W. Paramore, President of the Texas & St. Louis Railroad, and nine other railroad men held a conference at the Southern Hotel on August 7. A gentleman who was present says that General Devereux plumply expressed his wish to secure from Colonel Paramore the charter and franchises which he holds for the proposed St. Louis Belt Line Railroad. The gentleman stated that the Bee Line was determined to build a line of their own to Kansas City, and would begin work upon it as soon as a consultation was had with the parties interested in the East. The Belt road was characterized by General Devereux as a necessity for the Vanderbilt lines, and he said that as soon as they were satisfied of the soundness and correctness of the charter and franchises the New York Central and the Bee Line would go to work and build it.

CUT STONE FOR COURT-HOUSE, ETC., AT BALTIMORE.—The following is a synopsis of bids for cut stone for the superstructure of the court-house and post-office at Baltimore, Md.

Cape Ann Granite Company, $223,916.
Gill & McMahon, $265,029.
Hugh B. Hanna, $269,898.
Virginia State Granite Co., $277 575.
Mount Waldo Granite Works, $286,200.
Hamilton & Mann, $298,000.
Hamilton & Mann, $306,800.
Bodwell Granite Company, $317,718.
M. A. McGowan, $324,426.
Davis Tillson, $372,440.
Westham Granite Company, $398,969.
Lane & Malnati, $452,888.

The bid of the Cape Ann Granite Company, the lowest aggregate ($223,916), has been accepted.

HEATING APPARATUS FOR THE CUSTOM-HOUSE AT CINCINNATI.—The following is a synopsis of bids for the heating apparatus for the custom-house, etc., at Cincinnati, Ohio.

Samuel I. Pope & Co., $128,879.49.
J. D. Marshbank & Son., $144,831.77.
Bartlett, Hayward & Co., 146,448.
John Lyon, $146,847.46.
William Kickup & Son, $151,762.28

The lowest bid has been accepted.

ROLLED IRON BEAMS FOR COURT-HOUSE AT PITTSBURGH, PA.—The following is a synopsis of bids for rolled iron beams, etc., for the court-house, etc., at Pittsburgh, Pa.:

J. W. Walker, $2,525.
L. M. Morris, $2,555.08.
T. H. Brooks, $2,990.
Pottsville Iron and Steel Company, $3,002.22.
Snead & Co., Iron Works, $3,204.10.
Ritter & Conley, $3,440.
Phoenix Iron Co., Trenton, $3,531.46.

The lowest bid has been accepted.

IRON STAIRS AT ST. LOUIS, MO.—The following is a synopsis of bids for iron stairs to vaults in the custom-house, etc., at St. Louis, Mo.:

Snead & Co. Iron Works, $450.
Stupp Bros., $484.50.
Scherpe & Koken, $675.
Phœnix Iron Company, Trenton, N. J., $737.
Christopher & Simpson, $739.
Ætna Iron Works, Quincy, Ill., $1,062.
E. T. Barnum, $1,174.80.
W. H. Jackson & Co., $1,202.
McMurray & Co. Iron Works, $985.

The lowest bid has been accepted.

A CURIOUS MINING CONTEST.—A curious contest has arisen in San Francisco between certain amateur miners and the owners of a city lot. Workmen were engaged in excavating on the lot, which belongs to the firm of Durham, Carrigan & Co., with the purpose of preparing a foundation for a building. They struck a vein of black sand, which was found to contain gold. Every old Californian is, by instinct, a miner. Two of the workmen "got the color" at once, the first panful of sand "panning out" 15 cents, and the average running from 5 to 30 cents per pan. The miners, two in number, at once set up their claim, in accordance with law, claiming the whole of the lot as mining ground. For building purposes the lot is valued at $65,000, a sum far greater than the amateur miners could hope to dig out of the earth. Naturally the owners of the land say that the gold find on their premises is a mere delusion, and they adjure the workmen to go on with their excavations and foundation-laying. But the miners know that the right to dig for gold is sacred, and that no superficial ownership of the land can exclude them from burrowing under the surface. The title of the land is in Durham, Carrigan & Co. The mining rights are with the finders of the auriferous black sand.

WORTHINGTON HYDRAULIC WORKS.—This company have issued a new edition of their pump catalogue, to date of Aug. 1, 1883. Several new styles of steam pumping engines, designed and constructed by this firm, are illustrated; and new data and matter covering ten large quarto pages is added to the previous edition.

As an evidence of the prosperity of the company and the popularity of the pumps they construct, we note that from Jan. 1, 1881 to July 1, 1883, they have erected pumping engines at 56 different places in the United States, with contract pumping capacity of 230,000,000 gallons in 24 hours.

To the later date the total contract capacity of the pumps of this firm already in use is 750,000,000 gallons in 24 hours. Apply to 86 and 88 Liberty street for a copy of catalogue.

RAILROAD BUILDING IN IOWA is pretty active A syndicate of New York and St. Paul capitalists are having a survey made from St. Cloud, on the Manitoba Line, south to Mankato. Judge Barnes, of New York, formerly of the Manitoba road, is President, Gen. J. W. Bishop, of St. Paul, General Manager, and O. D. Brown, Chief Engineer. This is supposed to be the company that proposes to extend the Manitoba system to the Iowa coal fields.

The Rock Rapids *Reporter* claims to have information that the grading of the part of the Spirit Lake and Western between Sibley and Rock Rapids has been let to Patterson, of Ashton, a gentleman who has had a contract on the Northern Pacific.

The extension from Eldora to Alden, recently let by the Chicago, Iowa & Dakota Company, is twenty-two miles long. Alden is on the Illinoi Central, and is probably as far as the road will be extended this season.

It is expected to have the part of the Milwaukee's new line between Hedrick and Ottumwa ironed in twenty days. The tracklayers are already at work.

The Spirit Lake people are confident that the Milwaukee track, which now rests about five miles south of the town, will be extended in at once.

A party of engineers at West Point last week informered inquirers that they were running a survey for a road between Omaha and Yankton.

A party of Northwestern engineers are reported running a line west of the Jim Valley Line, now being built by the Milwaukee.

The engineers of the proposed Dubuque & Northwestern have gone out to seek a line.

The track of the Jim Valley Line has been laid from the north as far as Redfield.

THE CONTRACT FOR 45 MILES OF THE ATCHISON, TOPEKA & SANTA FE west of Wichita has been let. Material for bridging the Arkansas River at Wichita is accumulating.

THE BOUNDARY RECONNAISANCE.—The military party under Lieut. Symons, Engineer Corps, reached Carizalillo Springs lately. The survey of the first hundred miles on the parallel 31 deg. 47 min. is completed. The party now crosses the line to meet the Mexican detachment.

THE BOSTON WATER SUPPLY.—There is considerable scarcity of water in Boston at present. The Board has 400 men at work on the new basin at Ashland, and also on the Basin No. 2 in Framingham. The report of Mr. Wightman, the Engineer of the Board, calls attention to the increase of demand and decrease of supply. The present decline in the amount in store as compared with that of last year is 322,000,000 gallons on the Sudbury & Cochituate Works.

RAPID COMPLETION OF A BRIDGE.—The temporary bridge of the Grand Rapids & Indiana R. R. was finished in a few days. A week before the logs were 100 miles north of the city.

SPRINGFIELD (MASS.) WILL TRY THE ELECTRIC SYSTEM of Thomson-Houston. The cost of putting up the plant is estimated at $100,000.

THE TRACK OF THE N. O. & M. V. road has reached within 15 miles of Baton Rouge. The construction has been delayed by the amount of bridge work. Mr. C. Green, of the firm of Hazlehurst & Green, who have a large contract on the road north of Baton Rouge, states that he will finish up his contract, which consists of grading, about the middle of August. He reports that piling for bridges in the country is difficult to obtain; a great deal of the timber has to be floated down the Mississippi River.

A NEW BRIDGE is to be built at Joplin (Kansas). Only a few days were given for the opening of the bids.

THE MEMPHIS WATER SUPPLY.—A dispatch from Memphis under date of Aug. 3 says: The Citizens' Committee and Water-Works Company have had several conferences recently in reference to a supply of better water than is now furnished from Wolf River. There is a demand for Mississippi River water by the citizens, but the necessary expense of obtaining the same will cost an additional outlay of about $100,000 to the Water Company, which amount they say they are unwilling to expend, and thus the matter stands, with the prospects of an effort being made to declare the charter of the company forfeited, and a determined resistance on the part of the people to pay the water rates as demanded by the company for six months in advance.

THE RED MOUNTAIN DISTRICT (Col.) is reported by some examiners to be one of the richest mining regions in the world. The National Belle mine is estimated at $500,000, but the Yankee Girl far exceeds it.

DENVER WILL TRY TO TUNNEL the railroad crossings. Chief Engineer Rinker is visiting Indianapolis, etc., with a committee of inspection.

THE FAY MANUFACTURING CO., of Elyria, O., are meeting with increased sales of their Sulky Scraper. They have recently made some very valuable improvements in regard to its workings as well as materially increasing it strength. Wherever it has been used in competition with other wheeled scrapers it gives the best of satisfaction. Their orders at present are fully equal to their capacity.

FAILURE OF THE VERMONT NATIONAL BANK OF ST. ALBANS—The South-western Railway, extending from Montreal, Can., to Newport, Vt., has always been a struggle-for-existence concern. Bradley Barlow, President of the above bank, was its principal owner, and from the funds deposited in his institution, loaned to his railroad to the amount of $325,000. Negotiations for the sale of the road to

the Canada Pacific have been in progress for several months, but the canny owners of that huge bubble knew there was money in delay, and Mr. Barlow could not hold out any longer. Hence the collapse, leaving Barlow absolutely penniless, according to all accounts. Lawrence Brainerd, President of the St. Albans Trust Co., has also assigned his property to the Trust Co. to protect it against the consequences of his indorsing for Mr. Barlow.

FINANCIAL RELIEF TO MR. BARLOW.—MONTREAL, Aug. 9.—A rumor was current here to-day that the Southeastern Railroad had been purchased from Bradley Barlow by a syndicate composed of George D. Chapman, of the National Construction Company off New Jersey, Ashley Hibbard and Walter Shanley, of Montreal, and James Mitchell, of London, England, for $3,800,000 cash. This will leave Mr. Barlow a surplus of about $350,000 after paying off all his liabilities, including $1,400,000 to the Canadian Pacific road. Three months ago Mr. Barlow was offered $3,750,000 for the road, but refused it. He wanted $4,000,000. The purchasing syndicate is believed to represent the Grand Trunk and Central Vermont interests.

Mr. McMullen of this city has entered an action against the Southeastern Railroad Company for the recovery of a draft of $159,879 on the company which was protested.

Mr. Chapman said to-night that although negotiations were in progress, the purchase of the road has not yet been closed. He says that the syndicate will inspect the road to-morrow. Two more writs of seizure on the road, of $10,000 each, have been taken out.

ST. ALBANS, Vt., Aug. 8.—Bradley Barlow returned from New York this morning, but refused to give any information concerning the reported sale of the Southeastern Railroad. He says, however, that satisfactory arrangements are likely to be made soon. A meeting of the directors of the Southeastern road will be called at an early date, and, if Mr. Barlow is unsuccessful, decisive steps will be taken, as the creditors are already pressing the claims.

A NEW TELEGRAPH COMPANY.—NEW YORK, August 7.—A certificate of incorporation of the New England Telegraph Company has been filed. The lines run from this city through various cities and towns to Bangor, Me.

A NEW IOWA ROAD.—Six miles of the road from Atlantic, Ia., south to Kansas City, have been surveyed and let, and the remainder is now being rapidly pushed preparatory to letting.

GALVESTON, TEXAS, WATER-WORKS.—Aug. 7.—A contract for the construction of these works was to-day awarded to a strong syndicate. It is intended to at once lay 8 miles of mains and pipes, and locate 100 hydrants with a temporary pumping-house on the Bay to supply salt-water for fire purposes. The same system of pipes will be used for the fresh-water supply as soon as that is obtained. The works are ultimately to have a capacity of 6,000,000 gallons daily. By the terms of the contract the company are to furnish the city with fresh water within 12 months, and to complete the works in eighteen months. The city is to pay $125 each for the 100 hydrants per annum, for the salt-water supply.

UNDERGROUND WIRES.—Joseph B. Ecclesine, Jr., William S. Taylor, and H. Stevenson Beattie of this city, and William H. Johnstone of Philadelphia have filed in the County Clerk's office a certificate of incorporation of the New York Sectional Electric Underground Company. The proposed capital stock of the company is $2,500,000. At the offices at 15 Cortlandt street it was said yesterday that permission to open the streets for the laying of the wires had not yet been obtained, but it was thought that it could be obtained without any great trouble. It was also said that the company preferred to say nothing of its plans for the present. The proposed general route of the line of telegraph of the company is from the junction of Broad and Front streets, north through Broad street to Wall street, through Nassau street to Chatham street, to the Bowery, to Fourth avenue, to Seventeenth street, to Broadway, to Thirty-fourth street, up Sixth avenue to Fifty-eighth street, to Ninth avenue, to 110th street, to Eighth avenue, and to the Harlem River at McComb's Dam. In addition, it is proposed to have branches, parallel-routes, and cross-lines in most of the principal streets and avenues.

HARRISBURG & SOUTHWESTERN.—Application has been made for a charter for the Harrisburg and Southwestern Railroad Company, capital $5,000,000. The road will be 90 miles in length, through Dauphin, Cumberland, and Franklin counties. Robert H. Sayre, of Bethlehem, Penn., is President of the company.

EAU CLAIRE (WIS.) WATER-WORKS.—This enterprising little city is canvassing the feasibility of a public water supply. J. M. Brackett, postmaster, is enthusiastic on the subject.

PORT DEPOSIT BRIDGE.—The Board of Public Works of Maryland has approved the plan of the Baltimore & Ohio Railroad Company to build a bridge across the Susquehanna River at Port Deposit, ninety feet above high water, without a draw, for their branch road to Philadelphia. The company engages to keep a tug in constant readiness for the use of vessels passing under the bridge at the expense of the railroad.

UNDERGROUND HAULAGE.—A correspondent of the Newcastle *Journal* writes: "Considerable progress has been made of late in improving engines for this purpose. A few years ago Mr. Lishman and Mr. Young, of the Lambton collieries, on the Wear, secured a patent for working underground locomotives by means of compressed air, and the system has been carried out by them to a certain extent at the Lambton collieries, where those small compact engines are worked instead of horses to bring the coal tubs from the workings to the levels. Air-compressing engines are placed at the surface and the compressed air is conveyed down the shaft by pipes to certain stations in the workings, where the tank of the locomotive is charged from the reservoirs there with the compressed air at intervals as required. This experiment has shown that locomotives can be worked on this system successfully, and also economically, when compared with the cost of haulage by horses; but in this case no attempt has been made to work the entire haulage on the main levels, and thus supersede the use of hauling engines and the tail-rope system. The entire haulage underground has, however, been effected at a colliery in Yorkshire by means of these locomotives worked on the system described above. Pipes for the conveyance of the compressed air have been carried along the main levels, and air vessels placed at certain intervals, where the engines can be recharged when the store of compressed air is exhausted.

STREET RAILWAY.—Pierre is to have the first street railway line in southern Dakota.

A LABOR STRIKE—WASHINGTON, D. C., August 6.—An extensive strike took place to-day among the laborers upon the great boundary sewer for an increase from $1.25 to $1.50 per day. The bosses at the sewer believed a riot imminent, and telephoned for police to protect the men who persisted in going to work.

THE YELLOWSTONE SURVEY—SALT LAKE, U. T., August 6.—A non-commissioned officer, with a detachment of ten men, left for Fort Douglass yesterday, going on duty to survey the Yellowstone National Park.

THE CATSKILL (N. Y.) WATER-WORKS.—Messrs. Wilson and Croes, the engineers engaged to examine the plans for the Catskill, N. Y., water supply, have reported in favor of a supply by gravity in the ground of greater certainty of purity of the water, and less cost when pumping expenses are taken into consideration.

ROGERS & BALLENTINE, CONTRACTORS, have 100 convicts raising the track of the Morgan Branch Road to Avery's Island (La.).

THE CONTRACT FOR GRADING THE VICKSBURG, SHREVEPORT & PACIFIC for fifty miles is held by Rogers, Rexford & James, and is almost finished.

LOUISIANA CONTRACTS.—Rogers & Ballentine also have an uncompleted contract on the New Orleans division of the Texas and Pacific road, to surface up the track, which they will finish in a few weeks. They also have a contract north of the Atchafalaya River, and have moved their steam shovel down to the Bœuf crossing to load sand, which will be brought down to the force of Chinamen to surface track with. The shovel has a capacity of loading 18,000 yards of dirt a month.

THE SUEZ CANAL.—The revenue of this undertaking is increasing at a great rate. In 1882 the receipts were £2,420,953, as compared with £2,050,974 in 1881, and £1,593,619 in 1880.

VIENNA ELECTRICAL EXHIBITION.—The preparations for the Vienna Electrical Exhibition proceed very rapidly. Already a great amount of work has been accomplished in the main building, while the annexes are making rapid progress. Adjacent to the large chimney, for which 700 cubic metres of brick masonry have been employed, will be the boiler shed with two wings, built in right angles, each 94 metres in length; these will be connected with the machine hall by covered passages, and will occupy a space of 2,250 square metres. The whole earthwork in the galleries and the boiler shed amounts to about 2,000 cubic metres, while the masonry work measures for the boiler house and flues 250 cubic metres; for the foundations of 14 stationary boilers 150 cubic metres; for the foundations of 22 portable steam-engines 150 cubic metres; for the foundations of stationary engines and eight gas engines with about 1,200 horse-power for driving the dynamo machines, 1,200 cubic metres; for the foundations of the transmission dynamo machines, and different other arrangements, about 900 cubic metres; in all, therefore, about 3,350 cubic metres of masonry, the entire completion of which will take place within a few days. Already the consignments of exhibits from all parts of the globe begin to arrive, and the places will soon be occupied by boilers, machines, and other objects.

IRON AND METAL MARKETS.

PHILADELPHIA, AUG. 10.

The pig-iron market is strong and steady, with demand for small lots for current requirements at prices ranging from $16.50 for mottled iron to $18 for gray forge; No. 2 foundry is $20 and No. 1 $22@$22.50. The sales heard of during the past six days will foot up between 6,000 and 7,000 tons, though a much larger quantity has, no doubt, been disposed of for September and October delivery. The declining tendency is too strong to make it reasonable to expect much business for fall deliveries, but in the case of special and standard brands, where supplies are pretty well sold up, and production but little, if any, in excess of requirements, an active demand may be looked for from those who rely upon them for supplies. Muck bars are to be had as low as $34, but some of the better makes command $35. Merchant iron is weaker, and sales have been made as low as 2.10c., and even that figure is shaded by offerings from Western Pennsylvania, and the market is very much unsettled. Interior mills are selling merchant iron at 2c., and inquiries are in hand for car iron at from $\frac{1}{10}$@$\frac{2}{10}$ below this price. Some of the mills will not resume until September, and when they do it is expected that some sharp competition will arise. Several sales of steel rails have been reported in 500 to 2,000 ton lots for delivery in the Middle States. Large buyers for new roads are holding back. Some 50,000 tons could be sold, as inquiries are in hand for that amount. Large amounts of Bessemer pig will probably be sold before the close of the week. Asking price, $21@$21.50; bids, $20@$20.50. A thousand ton lots of Spiegeleisen have sold here at $30.50, and from 15,000 to 20,000 tons have been inquired for. Old rails are selling at $23 at ship; $21.50 is offered for large lots. Nails are in active request at $3.

PITTSBURGH.

A number of transactions in mill irons have been closed this week at $17@$17.50, but buyers generally are holding back, except to cover current requirements. Quite a number of consumers have supplies ahead for a month yet. The tone of the market is satisfactory, because of the fact that a large consumptive demand is assured. The supply of crude iron of all kinds will be large enough to prevent any upward tendency, and hence buyers continue to order small lots, in order to secure whatever advantages can be derived from a falling market. Foundry irons are selling in 50 to 100 ton lots. Notwithstanding the apparent inactivity, the total of consumption is large. Already, refined iron has dropped below $1.90. Sales have been made in Eastern and Middle Pennsylvania at $1.75 at mill. Nails are strong, owing to the 30 days' suspension; 2,500 nail machines will go into operation next week. The construction iron mills are working to full capacity. Orders for from 2,000 to 3,000 tons of bridge iron have been placed. Small orders for steel rails were booked at $38. Inquiries for 5,000 ton lots are in hand, and $37 is offered.

CHICAGO.

The consumption of pig iron in the Northwest is sufficiently active to make lake ore scarce. Buyers are beginning to order in larger quantities. No. 2 and 3 iron is quoted at $24.50. Scotch iron has also advanced, and is quoted at $23@$24.50. Southern iron is in fair demand, and is steady and firm. Foreign irons are in fair request. Ore is moving more freely, bottom prices having been reached. In a general way, the crude iron market is strong. Manufactured iron is unchanged at 2.05@2.10c., with shading on large orders. A fair movement is reported in construction iron. Sheet is moving more freely, and without shading. A more hopeful feeling prevails throughout the Northwest, but mill owners are resuming very cautiously, desiring to avoid over-production. Nails are in moderate supply, and prices are firm at $3.05@3.15. Orders for merchant steel come in slowly. Steel rails are quoted at $40, but few new orders have been received. Pig lead, 4.10c. Considerable movement has taken place in the hardware trade to meet the steady demand for building purposes.

CONTRACTORS' SUPPLIES MARKETS.

NEW YORK, Aug. 10.

There is a slightly improved condition in the lumber market. Bricks have been in rather less supply and prices have remained firm.

LUMBER—	
Pine, good	$55@$60
Pine, strip plank	33@ 35
Spruce plank, 1¼ inch	25@ 26
Shingles, clear sawed pine, 16 inch	4½ —
Yellow pine	30@ 40
BRICKS—	
Pale, ₩ M.	$3.25@$3.50
Jerseys	5.75@ 6.25
Up Rivers	6.00@ 6.25
Haverstraw Bay, 2ds	6.25@ 6.50
Haverstraw Bay, 1sts	6.62@ 6.87
Favorite brands	7.00@ —
Hollow Fire Clay Brick	9.00@ 9.25
FRONTS—	
Croton and Croton Points—Brown ₩ M.	$13.00@$14.00
Croton " —Dark	14.00@ 15.00
Croton " —Red	14.00@ 15.00
Philadelphia, on pier	27.00@ —
Trenton, "	27.00@ —
Baltimore, "	37.00@ —

CEMENTS, same as quoted July 28.